List of Appendices

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Appendix A
Compatibility Determinations

Appendix A - Compatibility Determinations

Compatibility Determination

Use: Environmental Education, Interpretation, Wildlife Observation, and Photography

Refuge Name: Antioch Dunes National Wildlife Refuge, Contra Costa County, adjacent to Antioch, California; a unit of Don Edwards San Francisco Bay NWR Complex.

Establishing and Acquisition Authority: Endangered Species Act of 1973, as amended (16 U.S.C. 1531 - 1544)

Refuge Purpose: "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species... or (B) plants..." (Endangered Species Act of 1973)

National Wildlife Refuge System Mission: The mission of the National Wildlife Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use(s): Environmental education, interpretation, wildlife observation, and photography are priority public uses of the National Wildlife Refuge System. As proposed, they would occur from outside the protective fence or under controlled visits inside the protective fence since the Refuge is otherwise closed to the public. Antioch Dunes NWR provides an opportunity for increasing awareness of the two endangered plants and one endangered insect species on the Refuge through guided tours and interpretive programs and information. There will be a concurrent opportunity for wildlife observation and photography during any led tours. Establishment of interpretive panels at a vehicle turnout will foster the above uses with little impact to Refuge resources. The Refuge was established to protect the unique riverine dune ecosystem which provides habitat for the endangered Antioch Dunes evening primrose (*Oenothera deltoides howellii*), Contra Costa wallflower (*Erysimum capitatum angustatum*) and Lange's metalmark butterfly (*Apodemia mormo langei*). Environmental education and interpretation at the Refuge will focus on endangered species. In addition, the Refuge will educate the public about the National Wildlife Refuge System and the Service mission. Currently, interpretive efforts and guided tours occur at the Refuge several times per year. Developing the vehicle turnout and interpretive panels would provide an avenue for viewing and increasing awareness when guided tours are not available. For additional details about these proposed uses, please see the Draft Antioch Dunes National Wildlife Refuge Comprehensive Conservation Plan and Environmental Assessment September 2001 (CCP/EA) which is herein incorporated by reference. Although the Refuge manager has the authority to close certain areas to public access, the State Lands Commission has reserved all lands below mean high water for public access. Thus, complete closure of the entire river beach by the Service would not be possible. To controll all access to the Refuge, the Refuge would pursue a lease of these beach areas.

Availability of Resources: Minimal staff exist to manage for environmental education, interpretation, wildlife observation, and photography at the Antioch Dunes National Wildlife Refuge. Volunteers to lead tours would need to be recruited and trained. Increased funding would be required for interpretive panels and educational materials.

Anticipated Impacts of the Use(s): The goals of the Refuge are:

1. To protect, restore, and manage the Antioch Dunes ecosystem for a diversity of native plant and animal species.

2. To protect, enhance, and maintain habitat for threatened and endangered species, emphasizing species known to inhabit the Refuge, including the Lange's metalmark butterfly, Contra Costa wallflower, and Antioch dunes evening primrose.

3. To establish an educational program for the public to foster an appreciation of the natural habitats and endangered species supported by the native riverine dune habitat of the Refuge.

Controlled access through guided tours at appropriate times for public participation supports the third goal and should have minimal impacts upon the first two goals of the Refuge, although the possibility exists of damaging endangered plants, disturbing endangered butterflies, and introducing unwanted plants through seed transfer while on guided tours. Currently, the endangered species are monitored and population impacts would be detected. The protective fence was established and uncontrolled access to the Refuge was stopped in 1986 due to endangered species being trampled and illegal campfires causing wildfires. For more information see the CCP/EA.

Public Review and Comment: Was conducted concurrently with the public review and comment perriod for the CCP/EA. All comments received and the Refuge responses were summarized in the final CCP. Comments received to date have been supportive of controlled visitor use.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible With Following Stipulations

Stipulations Necessary to Ensure Compatibility: The Refuge would remain closed to public use other than guided tours and interpretive opportunities outside the protective fence. Tours will be led by persons trained in identification, ecology and necessary restrictions of behavior in the vicinity of the endangered plants and butterfly. Protection of other native plants and animals on the Refuge will be incorporated into the guided tours.

Interpretive panels and materials used from outside the fence require no stipulations. Panels would not be constructed on areas that would impact endangered or other sensitive species.

Justification: The National Wildlife Refuge System Improvement Act of 1997 identifies environmental education, interpretation, wildlife observation, and photography as priority public uses for National Wildlife Refuges. As priority uses of the Refuge system, these uses take precedence over other potential public uses in Refuge planning and management. The Service strives to provide priority public uses when compatible with the purpose and goals of the Refuge and the mission of the National Wildlife Refuge System. The above four priority uses support one of the Refuge goals identified in the Comprehensive Conservation Plan, the purpose of the Refuge and the mission of the National Wildlife Refuge System.

Mandatory Re-evaluation Date (provide month and year for "allowed" uses only):

July 2017 Mandatory 15-year Reevaluation Date (for priority public uses)

_____ Mandatory 10-year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Conducted with the Comprehensive Conservation Plan

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____Environmental Impact Statement and Record of Decision

References Cited:

U.S. Fish and Wildlife Service. 2001. Draft Antioch Dunes National Wildlife Refuge Comprehensive Conservation Plan and Environmental Assessment

Refuge Determination:

Prepared by: Chris Bandy (Signature) 7/15/02 (Date)

Refuge Manager/ Project Leader Approval: Margaret J. Kolar (Signature) 7/16/02 (Date)

Concurrence:

Refuge Supervisor: Jack S Mills (Signature) 7/18/02 (Date)

Regional Chief, National Wildlife Refuge System: Acting Lowell W Cameron (Signature) 7/25/02 (Date)

Acting California/Nevada Operations Manager (for CA and NV): D. Kenneth Rice (Signature) 7-25-02 (Date)

Compatibility Determination

Use: Scientific Research

Refuge Name: Antioch Dunes National Wildlife Refuge, Contra Costa County, adjacent to Antioch, California; a unit of Don Edwards San Francisco Bay National Wildlife Refuge Complex.

Establishing and Acquisition Authority: Endangered Species Act of 1973, as amended (16 U.S.C. 1531 - 1544)

Refuge Purpose: "... to conserve (A) fish or wildlife which are listed as endangered species or threatened species... or (B) plants..." (Endangered Species Act of 1973)

National Wildlife Refuge System Mission: The mission of the National Wildlife Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use(s): Antioch Dunes National Wildlife Refuge (Refuge) receives periodic requests to conduct scientific research on the Refuge. Priority will be given to studies that contribute to the enhancement, protection, preservation and management of threatened and endangered species and their ecosystem. Research applicants must submit a proposal that would outline: 1) objectives of the study; 2) justification for the study; 3) detailed methodology and schedule; 4) potential impacts on Refuge endemic species and their ecosystem, including disturbance (short and long term), injury, or mortality; 5) Refuge and research personnel required; 6) costs to Refuge, if any; and 7) end products (i.e., reports, publications). Research proposals would be reviewed by Refuge staff or others as appropriate. Some research opportunities such as available pollinators, the effects of nitrogen fixing plants and the effects of the gypsum (nearby wallboard factory) in relation to the endangered species are identified in the Antioch Dunes National Wildlife Refuge Comprehensive Conservation Plan and Environmental Assessment (Draft) September 2001 (ADCCP/EA) which is herein incorporated by reference. Research would be accomplished under Special Use Permits (SUPs) since they enable the Refuge to tailor any additional stipulations (terms and conditions) to a specific research project.

The following criteria, and others as necessary, would be used to assess research proposals:

1. Research that would contribute to Refuge goals would have higher priority than other requests.
2. Research that would conflict with other ongoing research, monitoring or management programs would not be granted.
3. Research projects that can be done elsewhere off-Refuge are less likely to be approved.
4. Research which causes undue disturbance or is intrusive, will likely not be granted. Level and type of disturbance would be carefully weighed when evaluating a request.
5. Research evaluation would determine if any effort has been made to minimize disturbance through study design, including considering adjusting location, timing, scope, number of research personnel, study methods, number of study sites, etc.
6. If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area this may be reason to deny the request depending on the circumstances.
7. The length of the project would be considered and agreed upon before approval. Projects would not be open ended and would be reviewed annually.

Availability of Resources: Adequate funding and staff exist to monitor projects and compliance with stipulations presented herein and conditions of the Special Use Permits issued to researchers whose proposals are accepted for research at Antioch Dunes National Wildlife Refuge. As always, discretionary use of staff time is weighed through a cost/benefit analysis.

Anticipated Impacts of the Use(s): The goals of the Refuge are:
1. To protect, restore, and manage the Antioch Dunes ecosystem for a diversity of native plant and animal species.
2. To protect, enhance and maintain habitat for threatened and endangered species, emphasizing species known to inhabit the Refuge, including the Lange's metalmark butterfly, Contra Costa wallflower, and Antioch dunes evening primrose.
3. To establish an educational program for the public in order to foster an appreciation of the natural habitats and endangered species supported by the native riverine dune habitat of the Refuge.

Previous scientific research has directly contributed to the first two goals and provided information that has been and would continue to be used to support the third goal. The possibility exists of damaging endangered plants, disturbing endangered butterflies and introducing unwanted plants through seed transfer while doing research. There is also the potential for illegal collection of endangered plants and insects at the Refuge.

Minimal impact to Refuge resources is expected with scientific research studies. Some level of disturbance is expected with all research activities since most researchers would be entering areas that are normally closed to the public and may be collecting samples or handling wildlife. Special Use Permits would contain conditions to ensure that impacts to wildlife and habitats are kept to a minimum. Please see Chapter 4 of the CCP/EA for a discussion of problems and opportunities.

Public Review and Comment: Was conducted concurrently with the public review and comment period for the CCPlan/EA. No comments about research have been received to date.

Determination (check one below):

_____ Use is Not Compatible

__X__ Use is Compatible With Following Stipulations

Stipulations Necessary to Ensure Compatibility: Threatened and endangered species and Refuge resources will be monitored by Refuge staff. If the proposed research methods would impact or potentially impact Refuge resources, the research applicant must demonstrate to the Refuge's satisfaction that the research is necessary, and the researcher must identify the issues in advance of the impact. Minimization measures for potential impacts would need to be developed and be listed as conditions to the Special Use Permit. Extremely sensitive areas will be considered when determining locations for proposed research. At any time, refuge staff may accompany the researchers to determine potential impacts to Refuge resources. Staff may determine that previously approved research and Special Use Permits be terminated. All Refuge rules and regulations must be followed unless otherwise excepted in writing by the Refuge Manager.

Justification: Restrictions would be placed on the researcher to ensure that disturbance is kept to a minimum. Concerns about protecting rare native plants and animals and the overall integrity of the dune ecosystem require that Refuge staff closely review proposed research projects and that research activities be monitored. Research projects will contribute to the enhancement, protection, preservation, and management of native Refuge populations.

Mandatory Re-evaluation Date (provide month and year for "allowed" uses only):

July 2012 Mandatory 15-year Reevaluation Date (for priority public uses)

_____ Mandatory 10-year Reevaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

Conducted with the Comprehensive Conservation Plan

_____	Categorical Exclusion without Environmental Action Statement
_____	Categorical Exclusion and Environmental Action Statement
X	Environmental Assessment and Finding of No Significant Impact
_____	Environmental Impact Statement and Record of Decision

References Cited:

U.S. Fish and Wildlife Service. 2001. Draft Antioch Dunes National Wildlife Refuge Comprehensive Conservation Plan and Environmental Assessment

Refuge Determination:

Prepared by: Chris Bandy (Signature) 7/15/02 (Date)

Refuge Manager/ Project Leader Approval: Margaret J. Kolar (Signature) 7/16/02 (Date)

Concurrence:

Refuge Supervisor: Jack Stelle (Signature) 7/18/02 (Date)

Regional Chief, National Wildlife Refuge System: acting Lowell W. Adams (Signature) 7/23/02 (Date)

Acting California/Nevada Operations Manager (for CA and NV): [signature] (Signature) 7.25.02 (Date)

Appendix B
Technical Panel

Appendix B - Technical Panel

Antioch Dunes Technical Panel Participants from February 1999 Meeting

NAME	AFFILIATION
Richard Arnold, PhD	Consulting Entomologist
Peter Baye	USFWS, Endangered Species Recovery Branch Biologist
Joelle Buffa	USFWS, San Francisco Bay National Wildlife Refuge Complex, Supervisory Biologist
Sally de Becker	PG&E, Biologist
Joe DiTomaso, PhD	UC Davis, Biology Professor, starthistle specialist
Steve Edwards	Director, East Bay Regional Parks Botanic Garden
Barbara Ertter	Director, UC Berkeley - Jepson Herbarium
Erin Fernandez	USFWS, Wildlife Biologist in charge of Antioch Dunes NWR
Holly Forbes	California Native Plant Society - East Bay Chapter President, and UC Botanical Garden (Berkeley)
Julie Greene	Center for Natural Lands Management, Assistant Reserve Manager
Diana Hickson	Natural Heritage Division, California Department of Fish and Game
Melody Kercheval	PG&E, Sr. Associate Planner
John Lauenroth	Student Diablo Valley College, cryptogrammic soils expert
Leslie Lew	USFWS, Refuge Planner for Antioch Dunes National Wildlife Refuge
Wesley A. Maffei	Napa Co. Mosquito Abatement District, Manager
Sandra Matasol	USFWS, Biologist

Continued on page 2

Antioch Dunes Technical Panel Participants from February 1999 Meeting

(Continued from page 1)

NAME	AFFILIATION
Rick Morat	USFWS, Wildlife Biologist, Public Affairs Specialist
Chuck Morton	CalTrans, Senior Biologist
Michael Parker	USFWS, previous Wildlife Biologist in charge of Antioch Dunes NWR
Jerry Powell, PhD	UC Berkeley, Entomology Professor
John Randall, PhD	Nature Conservancy/UC Davis, Professor, weed specialist
John Rusmore	UC Davis, Graduate Student, Private Consultant, weed specialist
Victoria Slowik	USFWS, Biological Intern
Diane Thomson	UC Santa Cruz, graduate student
Louise Vicencio	San Pablo Bay NWR, Wildlife Biologist
Betty Warne	USFWS, Plant Biologist
David Wright	USFWS, Invertebrate Biologist
Loretta McCorkle	USFWS, Writer-Editor
Mark Pelz	USFWS, Refuge Planner
Don DeLong	USFWS, Supervising Refuge Planner

Antioch Dunes Technical Panel Participants from November 1999 Meeting

Name	Affiliation
Stephen Edwards	Director, East Bay Regional Parks Botanic Garden
Barbara Ertter	Director, UC Berkeley - Jepson Herbarium
Holly Forbes	California Native Plant Society - East Bay Chapter President, UC Botanical Garden (Berkeley)
Kari Jensen	USFWS, Biological Intern
Marge Kolar	USFWS, San Francisco Bay National Wildlife Refuge Complex Manager
John Lauenroth	Diablo Valley College, Student and cryptogrammic soils expert
Leslie Lew	USFWS, Refuge Planner for Antioch Dunes National Wildlife Refuge
Ivette Loredo	USFWS, Wildlife biologist in charge of Antioch Dunes National Wildlife Refuge
Wes Maffei	Napa Co. Mosquito Abatement District Manager
Linda Maldonado-Doyle	USFWS, Office Assistant
Loretta McCorkle	USFWS, Writer-Editor
Chuck Morton	CalTrans, Supervising Biologist
Bruce Pavlik	Mills College, Conservation Biology Professor
Mark Pelz	USFWS, Refuge Planner
Andrea Pickart	USFWS, Ecologist, Lanphere Dunes Unit, Humboldt Bay National Wildlife Refuge
Jerry Powell	UC Berkeley, Entomology Professor
Diane Thomson	UC Santa Cruz, graduate student

Appendix C
Environmental Assessment

Appendix C - Environmental Assessment

Under separate cover.

Appendix D
Response to Comments

CALFED
BAY-DELTA
PROGRAM

1416 Ninth Street, Suite 1155
Sacramento, California 95814

(916) 657-2666
FAX (916) 654-9780
http://calfed.ca.gov

November 16, 2001

Mark Pelz
Planning Team Leader
U.S. Fish and Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W-1916
Sacramento, CA 95825

Dear Mr. Pelz:

Thank you for the sending the document entitled "Antioch Dunes National Wildlife Refuge Draft Comprehensive Conservation Plan."

We have reviewed the plan and have comments as follows:

- The Service has correctly reported that the Refuge is in the study area of the CALFED Bay-Delta Program and has been specifically identified as a potential area for habitat restoration under the Ecological Restoration Program Plan (ERPP) of CALFED. The CALFED ERPP goals include protection and enhancement of the Refuge and surrounding dunes, the recovery of state listed rare species including, Mason's lilaeopsis (*Lilaeopsis masonii*), Suisum marsh aster (*Aster lentus*), delta tule pea (*lathyrus jepsonii var. jepsonii*) and Federally endangered species including Lange's, primrose, and wallflower, all of which can be found on the Refuge.

1 You may want to expand upon Chapter 6, "Funding" to list and discuss the CALFED Bay-Delta Program Proposal Solicitation Process (PSP), which usually occurs annually, as a possible supplemental funding source to meet the Refuge and CALFED objectives.

Please contact me at (916) 651-6478 should you need any further assistance on this matter.

Sincerely,

Michael F. Coleman, AICP
Environmental Specialist IV

cc: Terry Mills, CALFED
Bellory Fong, CALFED
Rebecca Fris, CALFED
Dan Ray, CALFED
Campbell Ingram, CALFED
Lauren Hastings, CALFED

CALFED Agencies

California

The Resources Agency
- Department of Water Resources
- Department of Fish and Game
- The Reclamation Board
- Delta Protection Commission
- Department of Conservation
- San Francisco Bay Conservation and Development Commission

California Environmental Protection Agency
- State Water Resources Control Board
- Department of Health Services
- Department of Food and Agriculture

Federal

Department of the Interior
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- Bureau of Land Management

Environmental Protection Agency
Army Corps of Engineers

Department of Agriculture
- Natural Resources Conservation Service
- Forest Service

Department of Commerce
- National Marine Fisheries Service

Western Area Power Administration

STATE OF CALIFORNIA - BUSINESS, TRANSPORTATION AND HOUSING AGENCY GRAY DAVIS, Governor

DEPARTMENT OF TRANSPORTATION
P O BOX 23660
OAKLAND, CA 94623-0660
(510) 286-4444
TDD (510) 286-4454

November 14, 2001

CC-4-28.94
CC004625
SCH# 2001104012

Mr. Mark Pelz
U.S. Fish and Wildlife Service
2800 Cottage Way, W-1916
Sacramento, CA 95825

Dear Mr. Pelz:

Antioch Dunes National Wildlife Refuge – Draft Comprehensive Plan/Environmental Assessment

1 Thank you for including the California Department of Transportation in the environmental review process for the above-referenced project. We have reviewed the Draft Comprehensive Plan/Environmental Assessment, and we are satisfied that the proposed activities will not significantly impact the State highway system.

If you have any questions regarding this letter, please call Rick Kuo of my staff at (510) 286-5988.

Sincerely,

RANDELL H. IWASAKI
Acting District Director

By Jean C. R. Finney

JEAN C. R. FINNEY
District Branch Chief
IGR/CEQA

c: Katie Shulte Joung (State Clearinghouse)

STATE OF CALIFORNIA GRAY DAVIS, *Governor*

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

PAUL D. THAYER, *Executive Officer*
(916) 574-1800 FAX (916) 574-1810
California Relay Service From TDD Phone **1-800-735-2922**
from Voice Phone **1-800-735-2929**

Contact Phone: **(916) 574-1868**
Contact FAX: **(916) 574-1885**

November 19, 2001

File Ref: SCH#2001104012

Ms. Nadell Gayou
The Resources Agency
1020 Ninth Street
Sacramento, CA 95814

Mr. Mark Pelz
U.S. Fish and Wildlife Service
2800 Cottage Way, W-1916
Sacramento, CA 95825

Dear Ms. Gayou and Mr. Pelz:

Staff of the California State Lands Commission (CSLC or Commission) has reviewed the proposed Antioch Dunes National Wildlife Refuge, Draft Comprehensive Conservation Plan/Environmental Assessment (CCP), SCH#2001104012. The CSLC is a responsible agency under the California Environmental Quality Act. Based on this review, we offer the following comments.

Jurisdiction

The State acquired sovereign ownership of all tidelands and submerged lands and beds of navigable waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all the people of the State for statewide Public Trust purposes, which include waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. The landward boundaries of the State's sovereign interests in areas that are subject to tidal action are generally based upon the ordinary high water marks of these waterways as they last naturally existed. In non-tidal navigable waterways, the State holds a fee ownership in the bed of the waterway between the two ordinary low water marks as they last naturally existed. The entire non-tidal navigable waterway between the ordinary high water marks is subject to the Public Trust. The State's sovereign interests are under the jurisdiction of the State Lands Commission.

The bed of the San Joaquin River is State-owned sovereign land under the jurisdiction of the State Lands Commission. Any activity waterward of the ordinary high

water mark is subject to the Commission's leasing requirements. In order for staff of the Commission to determine the extent of State-owned lands involved, we will need a detailed location map showing the exact location of the revegetation and removal of bank protection proposed. Please contact Lorna Burks, Public Land Management Specialist at (916) 574-1822 for information about the Commission's jurisdiction.

Environmental Review

The document identifies several sensitive plants that occur within the littoral zone of the Antioch Dunes, including Mason's lilaeopsis (*Lilaeopsis masonii*), Delta tule pea (*Lathryus jepsonii* var. *j.*), Delta mudwort (*Limosella subulata*), and Suisun Marsh aster (*Aster lentus*). Have the location of these species been mapped, populations quantified, and population trends determined for these sensitive plants? The CCP emphasizes strategies for the three federal endangered species; however, there should also be some efforts to monitor the other sensitive species that occur along the littoral zone of the Refuge. Any activities along the San Joaquin River shore should be assessed to ensure that these species are not negatively affected.

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Chapter 8 (Compliance Requirements) should include Clean Water Act (Section 404), Executive Order 13112 (Invasive Species), and Executive Order 13186 (Migratory Birds). Appendix D (Vascular Plant List) identifies Suisun Marsh aster as a federal endangered species. This species currently has no federal status. Delta mudwort should also be identified as a CNPS List 2 species.

4

We appreciate the opportunity to comment on the proposed environmental document and look forward to receiving the final Comprehensive Conservation Plan/Environmental Assessment when it is available. Please contact Eric Gillies (916) 574-1897, concerning the environmental review comments.

Sincerely,

Stephen L. Jenkins, Assistant Chief
Division of Environmental Planning
And Management

cc: Lorna Burks
Eric Gillies

COMMUNITY DEVELOPMENT Douglas R. Ward, Director

November 29, 2001

Mr. Mark Pelz, Planning Team Leader
U. S. Fish and Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W-1916
Sacramento, CA 95825

VIA ELECTRONIC MAIL

Re: Draft CCP/EA for the Antioch Dunes National Wildlife Refuge

Dear Mr. Pelz:

The City of Antioch would like to thank you for the opportunity to comment on the above conservation plan and environmental assessment. The City offers the following comments:

1

- **Strategy 1.7.1 and Section 2.3.8 *Public Use* under Alternative B – Draft Environmental Assessment:** Both sections reference the need for support from the Antioch Police Department, as well as the County Sheriff and other law enforcement agencies, to patrol the refuge on a limited basis in order to reduce trespassing.

  It should be noted that the Antioch Dunes National Wildlife Refuge is located outside the City of Antioch city limits and therefore the primary local contact for law enforcement support should be the Contra Costa County Sheriff's Department.

2

- **Fire Management Plan:** The Interagency Operations section of the Plan indicates that a Memorandum of Understanding is currently being established between the Refuge and the Contra Costa County FPD. The City strongly encourages the Refuge to continue in their cooperative dealings with the CCCFPD in order to provide for the protection of both the Dunes habitat and adjacent properties that may be susceptible to escaped fire.

The City looks forward to working with the Refuge to maintain and enhance our relationship and encourages the public use / out reach programs identified in the CCP.

Sincerely,

Tina Wehrmeister
Assistant Planner

Office of Director
Third & H Streets
P. O. Box 5007
Antioch, CA 94531-5007
(925) 779-7030
FAX (925) 779-7034

SIERRA CLUB

Delta Group of the San Francico Bay Chapter
2412 Cambridge Dr.,Antioch,Ca.94509 Tele 925-754-880

11-26-01

MARK PELZ, PLANNING TEAM LEADER
U.S. FISH & WILDLIFE SERVICE
CALIFORNIA / NEVADA REFUGE PLANNING OFFICE
2800 COTTAGE WAY, ROOM W-1916
SACRAMENTO, CALIF. 95825

DEAR MR. PELZ,

1 THE DELTA GROUP OF THE SIERRA CLUB SUPPORTS PROPOSED ACTION ALTERNATIVE D WHICH MANAGES THE ANTIOCH DUNES NATIONAL WILDLIFE REFUGE AS A MOSAIC WITH LIMITED AND CONTROLLED PUBLIC USE.

THE REFUGE IS A LIVING GEM AND WE ARE EXTREMELY THANKFUL THAT THE U.S. FISH & WILDLIFE SERVICE HAS ALLOWED OUR GROUP TO PARTICIPATE IN A GUIDED TOUR OF THE SITE OVER THE PAST YEARS.

VERY TRULY YOURS,

TIMOTHY P. DONAHUE
CHAIR - DELTA GROUP
OF THE SIERRA CLUB

Pacific Gas and Electric Company

Melody R. Kercheval
Senior Associate Planner
Building and Land Services

(415) 973-5769

245 Market Street, Room 1053B
San Francisco, CA 94105

Mailing Address:
Mail Code N10A
P.O. Box 770000
San Francisco, CA 94177

October 25, 2001

Mark Pelz, Planning Team Leader
U.S. Fish and Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W-1916
Sacramento, CA 95825

Re: Antioch Dunes NWR

Dear Mr. Pelz:

Thank you for this opportunity to review and comment on the Antioch Dunes National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment (Draft). Pacific Gas and Electric Company's (PG&E) comments on this plan are based on our concerns with portions of the Draft that inaccurately and inappropriately identify PG&E's operating utility property as part of the Sardis Unit and include it in the boundaries, goals, and objectives of the Antioch Dunes National Wildlife Refuge. In our telephone conversation this morning, you explained that the term "Approved Refuge Boundary" refers to land owned by the United States Fish and Wildlife Service (USFWS) as well as "planning areas" owned by other parties where the Refuge is authorized to enter into cooperative agreements or acquire additional land. However, since it is not appropriate for Refuge policies to govern privately owned land, the Comprehensive Conservation Plan and Environmental Assessment (CCP and EA) need to make a clear distinction between government-owned "Refuge" lands and privately owned "planning areas." The CCP and EA further need to clarify that policies adopted for the Refuge do not apply in planning areas that are privately owned.

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Although PG&E and USFWS are currently in the process of negotiating a new cooperative agreement, neither party has ever intended that PG&E transfer title to the government. PG&E's twelve acres are first and foremost operating utility property, and as such, the operating goals and objectives of the PG&E parcels are inconsistent with and cannot be governed by the goals and objectives of the Refuge. Furthermore, the operating goals and objectives of any agreement that may be negotiated between PG&E and USFWS cannot be limited by policies established in the CCP and EA.

PG&E's two parcels comprise approximately twelve acres that are adjacent to and outside the eastern and western boundaries of the Sardis Unit of the Antioch Dunes NWR. These two parcels are crossed by a 115 kilovolt (kV) electric transmission line and a 230 kV electric transmission line that are critical backbone resources providing power to the East Bay Area, a gas transmission line important to major manufacturing, and electric distribution facilities. Construction of the 115 kV tower on the west parcel in 1909 and the 230 kV tower on the east parcel in 1927 saved these two remnants of the Antioch Dunes ecosystem from mining and other development. In the past, through a cooperative agreement with USFWS, and subject to the paramount requirements of safe, reliable, cost-effective operation of the utility facilities located on those parcels, PG&E has allowed and funded enhancement of defined areas within those twelve acres to benefit endangered species in that remnant habitat.

Over the years, in addition to cooperating in habitat enhancement and biological surveys on selected areas of PG&E's two parcels, PG&E has contributed funds, materials, heavy construction equipment and labor in support of habitat enhancement and educational activities of the Antioch Dunes Refuge. PG&E's contributions have included the following:

- Donating, and hauling native riverine sand to the Sardis and Stamm Units and contouring dunes from that sand;
- Contributing funds for consultants to develop plans to enhance Lange's metalmark butterfly, primrose and wallflower habitats;
- Contributing funds to implement the butterfly, primrose and wallflower habitat enhancement plans;
- Contributing funds for surveys of status of candidate species on PG&E and Refuge properties;
- Developing and updating a training brochure;
- Making an educational video;
- Making and sharing base, vegetation, and ownership maps;
- Annual mowing on Refuge property; and
- Assistance with surveys and weeding.

Attached are our comments on specific portions of the Draft that PG&E believes require revision. Since PG&E's two parcels cannot be governed by the policies of the Refuge, this attachment does not include comments on the Draft's numerous references to public access or public use facilities on the Refuge. Needless to say, because of the energized electric lines and pressurized gas facilities that cross PG&E's property, safety considerations preclude unrestricted public access to PG&E's two parcels. The new cooperative agreement that PG&E and USFWS are currently negotiating will include provisions for limited access to PG&E's parcels for limited purposes and by limited categories of individuals or groups. This limited access to PG&E's parcels would be inconsistent with Alternative C of the Draft and in some instances, would be more restrictive than access anticipated under Alternatives A, B, or D.

Although PG&E remains committed to continuing to work cooperatively with USFWS in the management of our operating utility property, this cooperative management will continue to be limited by the requirements of maintaining and operating a safe, reliable, and cost-effective utility system. Please contact Buck Jones or me if you have any questions regarding our comments. Buck's phone number is 415-973-5874, and my phone number is 415-973-5769. We would also appreciate being copied on future correspondence regarding this subject as this project develops.

Sincerely,

Melody R. Kercheval

Melody R. Kercheval

Attachment

**Comments by PG&E on the
Antioch Dunes National Wildlife Refuge
Draft Comprehensive Conservation Plan and
Environmental Assessment
October 2001**

Page 5, Figure 2. Antioch Dunes National Wildlife Refuge: Revise the annotations and Approved Refuge Boundary on this map to clarify that only land owned by USFWS
3 is subject to the goals, objectives and policies of the Refuge CCP and EA, and that privately owned lands are identified on this map only to indicate planning areas where the Refuge is authorized to enter into a cooperative agreement or purchase additional land.

Page 6, *Land Ownership*: Delete the first two sentences of this section and replace them with the following text, "The approved Refuge boundary encompasses 55 acres owned by the Service. PG&E owns 12 acres adjacent to the Sardis Unit that are part of
4 the same remnant dune ecosystem. In the past, through a cooperative agreement with USFWS, and subject to the paramount requirements of safe, reliable operation of the utility facilities located on those parcels, PG&E has permitted and funded enhancement of defined areas within those twelve acres to benefit endangered species in that remnant habitat."

Page 6, *Land Ownership*: Delete the last sentence of this section and replace it with the following text, "The goals, policies, and objectives of this CCP are intended to
5 govern only lands owned by the Service. References to PG&E's twelve acres in this CCP are included only to identify PG&E's land as a planning area where the Refuge is authorized to enter into a cooperative agreement and, where appropriate, to provide additional scientific data on the status of the remnant dune ecosystem."

Page 15, *Issues Identified by Staff, Panel of Experts, and Other Agencies*: Revise
6 the text in the first bullet to read, "Develop and complete an agreement with PG&E for long-term management of portions of the 12 acres they own adjacent to the Refuge."

Page 19, Figure 4. Management Areas with Acreages: As stated on page 6 of the Draft, "This CCP will only address management of lands owned by the Service." In addition, a new cooperative agreement between PG&E and USFWS is still under negotiation, and the Management Areas as shown on Figure 4 of the Draft CCP have
7 not been defined in the current draft cooperative agreement. For these reasons, it is not appropriate for this map to identify proposed Management Area names or acreages on the PG&E parcels or even to include the PG&E property. Make the following revisions to this map:

1. Add the property lines separating the PG&E and USFWS parcels.
2. Revise the annotations and Approved Refuge Boundary on this map to clarify that only land owned by USFWS is subject to the goals, objectives and policies of the

Refuge CCP and EA, and that privately owned lands are identified on this map only as planning areas where the Refuge is authorized to enter into a cooperative agreement or purchase additional land.

3. Correct the legend for the golden area outlined in green to read, "Survey Units on PG&E Property."

Page 25, Figure 5. Three main habitat types on the Refuge: PG&E's two parcels are erroneously shown as being part of the Refuge.

8
1. Add the property lines separating the PG&E and USFWS parcels, and label the land owned by PG&E.
2. Revise the annotations and Approved Refuge Boundary on this map to clarify that only land owned by USFWS is subject to the goals, objectives and policies of the Refuge CCP and EA, and that privately owned lands are identified on this map only as planning areas where the Refuge is authorized to enter into a cooperative agreement or purchase additional land and to provide additional scientific data on the status of the remnant dune ecosystem.

Page 38, Figure 10. Sardis Unit Densities (no./acre Based on 1998 Counts: PG&E's two parcels are erroneously shown as part of the Sardis Unit.

1. Change the title of Figure 10 to "Sardis Unit and PG&E Densities (no./acre Based on 1998 Counts."
2. Add the property lines separating the PG&E and USFWS parcels.

9
3. Label the Sardis Unit.
4. Label the PG&E parcels.
5. Add an annotation to this map to clarify that privately owned lands are shown on this map only to provide additional scientific data on the status of the remnant dune ecosystem and because they are planning areas where the Refuge is authorized to enter into cooperative agreements or purchase additional land.

Page 39, *Importing Sand*: Revise the third sentence of this section to read, "To create new dunes on the Refuge, PG&E donated, hauled, and contoured native riverine sand

10 from a stockpile at a power plant formerly owned by PG&E about one mile from the eastern boundary of the Refuge."

Page 55, Figure 11. Proposed Management for Antioch Dunes National Wildlife Refuge: The two PG&E parcels are erroneously shown as being part of the Sardis Unit. Make the following revisions to the map of the Sardis Unit:

1. Show the property lines separating the PG&E parcels from the Sardis Unit.
2. Identify the PG&E land as privately owned property.

11
3. Revise the approved Refuge Boundary and add annotations to distinguish privately owned land from USFWS land, to clarify that only land owned by USFWS is subject to the goals, objectives and policies of the Refuge CCP and EA, and that privately owned lands are identified on this map only as planning areas where the Refuge is authorized to enter into a cooperative agreement or purchase additional land.

12 **Page 58, Section 2.6.1**: Revise this sentence to read, "Finalize and maintain a cooperative agreement with PG&E for long-term management of portions of the 12 acres they own adjacent to the Refuge."

13 **Page 93, Section 1.4 Project Area, last paragraph**: Delete the first two sentences of this paragraph and replace them with the following text, "The approved Refuge boundary encompasses 55 acres owned in fee by the Service. Two parcels adjacent to the eastern and western boundaries of the Sardis Unit of the Refuge are owned by PG&E. In the past, under a cooperative agreement and subject to the paramount requirements of safe, reliable, cost-effective operation of the utility facilities located on the twelve acres comprising PG&E's parcels, PG&E has permitted and funded enhancement of defined areas within those twelve acres to benefit endangered species in that remnant habitat. Because PG&E's 12 acres are privately owned, they are added to the Approved Refuge Boundary only to indicate that they are a planning area where the Refuge is authorized to enter into a cooperative agreement or purchase additional land. Only lands owned by USFWS are subject to the goals, objectives and policies of the Refuge."

14 **Appendix C. Draft Environmental Assessment, Page 5, Figure 2. Antioch Dunes National Wildlife Refuge**: This map erroneously shows PG&E's two parcels within the Approved Refuge Boundary. Revise the annotations and Approved Refuge Boundary on this map to clarify that only land owned by USFWS is subject to the goals, objectives and policies of the Refuge CCP and EA, and that privately owned lands are identified on this map only to indicate planning areas where the Refuge is authorized to enter into a cooperative agreement or purchase additional land.

15 **Page 97, Section 1.9.1 *Purpose of Antioch Dunes National Wildlife Refuge*, Paragraph 2**: Revise the second sentence to read, "Although substantially augmented by outplantings, the 55 acres within the government-owned Refuge, along with portions of the PG&E parcels, the Georgia-Pacific gypsum plant and Kemwater properties, support the last known natural populations of the primrose, wallflower, and Lange's."

16 **Unnumbered page 105, Figure 4. Alternative A - Sardis Unit**: PG&E's parcels are erroneously shown as part of the Sardis Unit.

1. Add the property lines separating the PG&E and USFWS parcels.
2. Label the Sardis Unit.
3. Label the PG&E parcels.

17 **Unnumbered page 109, Figure 6. Sardis Unit Alternatives**: The two PG&E parcels are erroneously shown as part of the Sardis Unit. Either delete the PG&E parcels from this Figure, or revise the Approved Refuge Boundary and add annotations to this map to distinguish the government-owned refuge land from privately owned property, to clarify that privately owned lands are shown on this map only because they are planning areas where the Refuge is authorized to enter into cooperative agreements or

purchase additional land, and that the goals, objectives, policies, and alternative analyses of this CCP do not apply to privately owned lands.

Page 204, Figure 2: Sardis Unit: The two PG&E parcels are erroneously shown as being part of the Sardis Unit and within the Approved Refuge Boundary.

18
1. Change the title of this figure to "Sardis Unit and PG&E Parcels."
2. Add the property lines that separate the Sardis Unit from the PG&E parcels.
3. Identify the PG&E parcels as privately owned land.
4. Change the legend for the yellow area circled in green to read, "Survey Units on PG&E Property."
5. Revise the Approved Refuge Boundary and add annotations to this map to clarify that privately owned lands are shown on this map only because they are planning areas where the Refuge is authorized to enter into cooperative agreements or purchase additional land, and that the goals, objectives, and policies of this CCP do not apply to privately owned lands.

Page 229, first paragraph: Revise the first two lines to read, "Although the habitat has been substantially augmented by outplantings, the 55-acre Antioch Dunes National
19 Wildlife Refuge (Refuge) and portions of the adjacent 12-acre Pacific Gas and Electric Company (PG&E) land support the last remaining populations of the three endangered species including the . . . . "

Page 243, first paragraph: Revise the first three lines to read, "Although the habitat has been substantially augmented by outplantings, the 55-acre Antioch Dunes National
20 Wildlife Refuge (Refuge) was established to protect a unique riverine dune ecosystem, which in addition to portions of adjacent Pacific Gas and Electric Company land, which has also been substantially augmented by outplantings, support the last remnants of natural populations of three endemic endangered species, the Antioch Dunes . . . ."

November 30, 2001

Mr. Mark Pelz, Planning Team Leader
U.S. Fish and Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W-1916
Sacramento, California 95825

Subject: Antioch Dunes National Wildlife Refuge Draft Comprehensive Conservation Plan. Date: September 2001

Dear Mr. Pelz:

We have reviewed the subject document and have the following comments.

1 Alternative D is the plan that should be used to guide the Refuge in maintaining the Antioch Dunes National Wildlife Refuge. We agree that Alternative C should be incorporated into the guiding plans except that there should be limited public use.

2 The terrain at both sites is not conducive for daily public use. At the present time our understanding of public use is for guided and controlled educational groups, and only when someone from USFWS or from DESFBNWR is available to guide the group.

3 Weed control is of prime concern. All methods should be used to control the non-native vegetation. Non-native weed control should be first priority.

4 Perhaps the Refuge should reconsider continuing to plant the native endangered species until the weeds are under control. Having more native plants in some areas makes it more difficult to control weeds with spraying or burning methods.

As volunteers at the Refuge, who have worked at Antioch, we feel strongly that Antioch Dunes should be preserved and protected.

Sincerely yours,

Frank and Janice Delfino

Frank and Janice Delfino
18673 Reamer Road
Castro Valley, California 94546
Phone: 510-537-2387

Steven A. Janosik
6118 Lynn Rd.
Tampa, FL 33625
(813) 960-9281

November 6, 2001

Mr. Mark Pelz
Planning Team Leader
U.S. Fish and Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W1916
Sacramento, CA 95825

Dear Mr. Pelz :

I am writing in regards to the Draft Comprehensive Conservation Plan and Environmental Assessment for Antioch Dunes National Wildlife Refuge. I have been to a few National Wilderness Areas and Refuges in the Eastern United States and will plan future trips. Although I do not reside in California, I am planning a summer trip; hopefully, the Antioch National Wildlife Refuge will be part of it. As a student of Civil and Environmental Engineering who has contacts with those in Environmental Science, I am continually reminded of the need for natural ecosystem preservation/restoration. I strongly support your efforts to restore the Antioch Dunes and protect the endangered species that are located in and around the refuge area. I also support the additions in the Draft CCP/EA such as limited and controlled public use.

My philosophy in any wilderness setting has been to leave it as I found it. More recently, however, it has become to leave it as it should be by packing out trash that others left behind. Some seem to have the propensity to litter. I believe it would be detrimental to the refuge area if it were opened to unrestricted public use. From what I have read, the area seems to be at a sensitive stage of development. Footpaths and viewing areas along designated routes seem to be feasible recreational activities for the refuge area. As is stated in the report, disturbance caused by light foot travel could be beneficial to the primrose population along with other species in the refuge. Footpaths along relevant, non-sensitive areas could be used to study the benefits of light disturbance on primrose and other plant species populations. The donations received from visitors to the refuge area could be used to help finance current projects.

1

2

3

I request that you consider my suggestions for limited public use regarding designated footpaths, if feasible. Thank-you for your time and willingness to consider my views. Please inform me about your position on this matter and any relevant action(s) you have taken. Any additional information you wish to provide would be appreciated, also.

Sincerely,

Steven A. Janosik

Diane Milan

11/07/2001 01:29 PM

To: Mark Pelz/SAC/R1/FWS/DOI@FWS
cc: Kay KierHaggenjos/RO/R1/FWS/DOI@FWS
Subject: Antioch Dunes NWR

----- Forwarded by Diane Milan/RO/R1/FWS/DOI on 11/07/01 01:23 PM -----

"Lisa W. Kroeber" <lkroeber@ix.netcom.com>

11/07/01 12:47 PM

To: FW1PlanningComments@FWS.gov
cc:
Subject: Antioch Dunes NWR

Draft Conservation Plan & EIS for Antioch Dunes NWR

Dear FWS:

1 I am writing to register my support for your alternative ("D"), in this Conservation Plan. It sounds to me like that design will allow Antioch Dunes to come close to being a real refuge.

Thanks. Lisa Kroeber

November 1, 2001

CA/NV Refuge Planning Office
2800 Cottage Way, W-1916
Sacramento, CA 95825

To Whom It May Concern:

SUBJECT: ANTIOCH SAND DUNES

Hi. My name is Rebecca Valdez and I am currently a student at Los Medanos College in Pittsburg, California. In my Environmental Biology class, I took a trip to the Antioch Dunes National Wildlife Refuge. While I was at this location, I was shocked to find out that it was a refuge for the Lange's metalmark butterfly, the Contra Costa Wall flower, and the Antioch Dunes evening primrose. These plants and animals are very important to the environment.

1 The largest reason I am writing this letter is to ask why there is no visitors' center for the Dunes nest to the dunes. My professor (Christine Hagelin) told the class that there is one located in Fremont. Why is it so far away from the park?

You could raise money for a visitor's center with donation money from the public. People could go around the neighborhoods and ask to become a member of the Dunes visitors' center fund. The people that work in the center could all be volunteers that want to help out the environment and can be educated on the dunes and animals that live in the area. There are also grants that the government can give for the construction of the center.

With a visitor's center closer to the dunes, people would know about the dunes. They would be educated on the fact that it is a place that has those three endangered species and that is the only place in which you can find them. In the visitor's center, you could also talk about the other wildlife around the dunes. You could also educate the public about the creek across the road. The Autobahns Society is trying to build a bird habitat in the creek. I would like to thank you for talking the time in order to read my letter.

Sincerely,
Rebecca L Valdez
Rebecca Valdez

5136 STRATFORD DRIVE
OAKLEY, CA 94561

CALFED Bay-Delta Program

Response to Comment 1:
The text has been changed to reflect the comment given.

California Department of Transportation

Response to Comment 1:
Thank you for your comment.

California State Lands Commission

Response to Comment 1:
The locations of these plants were recently mapped in a cooperative effort between the refuge and the California Native Plant Society. However, populations have not been quantified, nor have trends been determined. Objective 2.7 seeks to restore the littoral zone. Strategy 2.7.1 seeks to determine the natural condition of the shoreline ecosystem. A trend analysis would likely be a part of any restoration effort.

Response to Comment 2:
Currently, the Service has no jurisdiction over the State Lands within the littoral zone. The Service may seek to expand the Approved Refuge Boundary to include the littoral zone or possibly leasing these lands from the State Lands Commission (see strategy 2.6.4). Should that occur, the Service would then be more actively involved in the management of plants in the littoral zone.

Response to Comment 3:
Concur.

Response to Comment 4:
The text has been changed to reflect the comment given.

City of Antioch - Community Development Department

Response to Comment 1:
The text has been changed to reflect the comment given.

Response to Comment 2:
Concur.

Sierra Club

Response to Comment 1:
Concur.

Pacific Gas and Electric Company

Response to Comment 1:
The CCP does not intend to portray PG&E land as part of the Sardis Unit. The figures and text have been further clarified to reflect that the goals, objectives, and strategies do not apply to PG&E land.

Response to Comment 2:

An approved refuge boundary gives service authority to acquire land contained within the boundary. The approved refuge boundary identifies important and sensitive resource areas that the Service is looking to protect for a long period of time. Landowners within a refuge boundary retain all the rights, privileges, and responsibilities of private land ownership. After the Director approves a refuge boundary, the Service can make offers to purchase land, or enter into management agreements with willing landowners within the approved boundary. Lands do not become part of the National Wildlife Refuge System unless they are purchased or are placed under a management agreement with the individual landowner. The text has been changed to further clarify that the CCP does not apply to privately owned lands.

Response to Comment 3:

The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 4:

The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 5:

The text has been revised to reflect the comment given.

Response to Comment 6:

Although the agreement restricts the Service from conducting certain types of activities on portions of the 12 acres, the previous cooperative management agreement and subsequent draft agreements apply to the entire 12 acres.

Response to Comment 7:

The figure has been changed to say "Survey Areas" vs. "Management Areas."

Response to Comment 7.1:

The map already clearly delineates PG&E property from Service property.

Response to Comment 7.2:

The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 7.3:

The figure has been changed to reflect the comment given.

Response to Comment 8.1:

The figure has been changed to reflect the comment given.

Response to Comment 8.2:

The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 9.1:

The figure has been changed to reflect the comment given.

Response to Comment 9.2:

The figure has been changed to reflect the comment given.

Response to Comment 9.3:

The figure has been changed to reflect the comment given.

Response to Comment 9.4:

The figure has been changed to reflect the comment given.

Response to Comment 9.5:

The text has been revised to reflect the comment given. Also, the term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 10:

The text has been revised to reflect the comment given.

Response to Comment 11.1:

This figure already clearly delineates the PG&E property.

Response to Comment 11.2:

Please see response to comment 11.1.

Response to Comment 11.3:

The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 12:

Please see response to comment 6.

Response to Comment 13:

The text has been changed to reflect the comment given.

Response to Comment 14:

The two PG&E parcels are within the approved refuge boundary. The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section of the CCP and under the "Project Area" section of this EA.

Response to Comment 15:

The text has been changed to reflect the comment given.

Response to Comment 16.1:

The figure has been changed to reflect the comment given.

Response to Comment 16.2:

The figure has been changed to reflect the comment given.

Response to Comment 16.3:

The figure has been changed to reflect the comment given.

Response to Comment 17:

The figure has been changed to reflect the comment given. The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 18.1:

The figure has been changed to reflect the comment given.

Response to Comment 18.2:

The figure has been changed to reflect the comment given.

Response to Comment 18.3:

The figure has been changed to reflect the comment given.

Response to Comment 18.4:

The figure has been changed to reflect the comment given.

Response to Comment 18.5:
The text has been revised to reflect the comment given. The term "approved refuge boundary" has been further clarified under the "Land Ownership" section.

Response to Comment 19:
This section is from a document finalized in 1997 and cannot be changed.

Response to Comment 20:
This section is from a document finalized in 1997 and cannot be changed.

Frank and Janice Delfino

Response to Comment 1:
Concur.

Response to Comment 2:
Concur.

Response to Comment 3:
Concur.

Response to Comment 4:
The Service has been moving in this direction on the Refuge. Recently, we have been concentrating planting efforts on areas that have been treated for weeds with prescribed fire. However, it is likely that we will continue some planting throughout the refuge to maintain populations of the primrose, wallflower, and naked-stemmed buckwheat on the portions of the refuge that have not yet been treated.

Steven A. Janosik

Response to Comment 1:
Concur. The Service's preferred alternative does not open the Refuge to unrestricted public use.

Response to Comment 2:
An interpretive viewing area has been identified for Minaker Drive. This viewing area would be open all the time. The preferred alternative includes footpaths. However, these footpaths will not be open to unrestricted public use because of the sensitivity of the endangered species.

Response to Comment 3:
An investigation of a variety of different disturbance measures is identified as strategy 1.5.2 and includes supervised public use.

Lisa W. Kroeber

Response to Comment 1:
Concur.

Rebecca Valdez

Response to Comment 1:
A visitor center was considered as part of the comprehensive conservation planning process, and was not included for two main reasons. With only 55 acres, the refuge is very small - there isn't really adequate space on

the Refuge for a visitor center. The footprint of any visitor center would further reduce the amount of potential habitat for the endangered species. Also, at this time, not enough public interest has been expressed in the Refuge to merit constructing a visitor center. However, the plan does identify a viewing area with interpretive panels at Minaker Drive. Should funds become available, this viewing area would act as a mini visitor center. Furthermore, there are currently plans to construct the Delta Science Center adjacent to the City of Antioch in Oakley, a regional science center that could feature a display about the Refuge and its unique species. An additional strategy has been added to the CCP to work with the staff developing the center and interpretive programs.

Appendix E
Wilderness Review

Appendix E - Wilderness Review

A wilderness review is the process used by the U.S. Fish and Wildlife Service (Service) to determine whether or not to recommend lands or waters in the National Wildlife Refuge System to Congress for designation as wilderness. The Service is required to conduct a wilderness review for each refuge as part of the Comprehensive Conservation Plan (CCP) process. Lands or waters that meet the minimum criteria for wilderness are identified in a CCP and further evaluated to determine whether they merit recommendation for inclusion in the Wilderness System.

According to Section 13 of the Service's Director's Order No. 125 (12 July 2000), for a refuge to be considered for wilderness designation, all or part of the refuge must:

- Be affected primarily by the forces of nature, with the human imprint substantially unnoticeable;
- Have outstanding opportunities for solitude or a primitive and unconfined type of recreation;
- Have at least 5,000 contiguous acres (2,000 ha) or be sufficient in size to make practicable its preservation and use in an unimpaired condition, or be capable of restoration to wilderness character through appropriate management, at the time of review; and
- Be a roadless island.

The Antioch Dunes National Wildlife Refuge (Refuge) comprises 55 acres, which is much smaller than the area required for designation as wilderness. Moreover, the Refuge contains much evidence of past human use, including dirt roads, remnants of an old vineyard, rip rap, and an abandoned sand quarry. For these reasons, the Refuge does not meet the criteria for wilderness designation.

Appendix F
Plant List

Appendix F - Vascular Plant List For Antioch Dunes National Wildlife Refuge

Current Plant Species at Antioch Dunes National Wildlife Refuge. Compiled from California Native Plant Society surveys and other sources. 1974 - 2001.

SEAFIG FAMILY (*AIZOACEAE*)
Ice Plant *(Carpobrotus edulis)*

AMARANTH FAMILY (*AMARANTHACEAE*)
Tumbleweed (Pigweed) *(Amaranthus albus)*
Prostrate Amaranth *(Amaranthus blitoides)***N
Amaranthus *(Amaranthus sp.)*

AMARYLLIS FAMILY (*AMARYLLIDACEAE*)
Naked Ladies *(Amaryllis belladonna)*

CASHEW FAMILY (*ANACARDIACEAE*)
California Pepper Tree *(Schinus molle)?*N
Poison Oak *(Toxicodendron diversilobum)*N

CELERY(CARROT) FAMILY (*APIACEAE*)
Button-celery (Coyote Thistle) *(Eryngium aristulatum)***N
Fennel *(Foeniculum vulgare)*
Floating Marsh Pennywort *(Hydrocotyle ranunculoides)***N
Whorled Marsh Pennywort *(Hydrocotyle verticillata)***N
Mason's Lilaeopsis *(Lilaeopsis masonii)**N (CA RARE/CNPS 1B)
Water Parsley *(Oenanthe sarmentosa)*N
Hemlock W*ater Parsnip (Sium suave)***N

DOGBANE FAMILY (*APOCYNACEAE*)
Indian-hemp *(Apocynum cannabinum)***N
Oleander *(Nerium oleander)*

MILKWEED FAMILY (*ASCLEPIADACEAE*)
Narrow-leaf Milkweed *(Asclepias fascicularis)*N

ASTER FAMILY (*ASTERACEAE*)
Yarrow *(Achillea millefolium)*N
Western Ragweed *(Ambrosia psilostachya)*
Unknown *(Ambrosia sp.)*
Mugwort *(Artemisia douglasiana)*N
Suisun Marsh Aster *(Aster lentus)**N (CNPS 1B)
Coyote Brush *(Baccharis pilularis)*N
Mule Fat *(Baccharis salicifolia)*N
Bur Marigold *(Bidens laevis)***N
Italian Thistle *(Carduus pycnocephalus)*
Slender-flowered Thistle *(Carduus teniflorus)?*
Tocalote *(Centaurea melitensis)*
Yellow Starthistle *(Centaurea solstitialis)*
Spikeweed *(Centromadia pungens ssp?)*N
Horseweed *(Conyza canadensis)*
Kellogg's Tarweed *(Deinandra kelloggii) (formerly by Hemizonia k.)***N
Western Goldenrod *(Euthamia occidentalis)****N

California Fluffweed *(Filago californica)*N
Herba Impia (Fluffweed) *(Filago gallica)*N
Fragrant Everlasting *(Gnaphalium canescens ssp. beneolens)***N
Common Cudweed *(Gnaphalium luteo-album)*
Cotton Batting Plant *(Gnaphalium stramineum)*N
Cudweed *(Gnaphalium sp.)*
Gumplant *(Grindelia camporum var. camporum)*N
Hirsute Grindelia *(Grindelia hisutula var. h.)***N
Marsh Gumplant *(Grindelia stricta var. angustifolia)***N (CNPS 4)
Grindelia *(Grindelia sp.)*N
California Matchweed *(Gutierrezia californica)****N
Bigelow's Sneezeweed *(Helenium bigelovii)***N
Hayfield Tarweed *(Hemizonia congesta ssp. c.)***N
Telegraph Weed *(Heterotheca grandiflora)*N
Bristly Golden Aster *(Heterotheca sessiliflora ssp. echioides)****N*
Tarweed *(Holocarpha sp.)*N
Smooth Cat's Ear *(Hypochaeris glabra)*
Rough Cat's Ear *(Hypochaeris radicata)*
Prickly Lettuce *(Lactuca serriola)*
California Goldfields *(Lasthenia californica)*N
Tidy-tips *(Layia platyglossa)****N
Glandular Lessingia *(Lessingia glandulifera var. g.)***N
Slender Cottonweed *(Micropus californicus var. c.)*N
Cupped Monolopia *(Monolopia major)***N
Bristly Ox-tongue *(Picris echioides)*
Bush Groundsel (Shrubby Butterweed) *(Senecio flaccidus var. douglasii)***N
Alkali-marsh Butterweed *(Senecio hydrophilus)***N
Common Butterweed *(Senecio vulgaris)*
Unknown (wet grower) *(Senecio sp.)*
Prickly Sow Thistle *(Sonchus asper)*
Common Sow Thistle *(Sonchus oleraceus)*
Purple Salsify *(Tragopogon porrifolius)*
Cocklebur *(Xanthium strumarium)*N

BIRCH FAMILY (*BETULACEAE*)
White Alder *(Alnus rhombifolia)*N

BORAGE FAMILY (*BORAGINACEAE*)
Common Fiddleneck *(Amsinckia menziesii var. intermedia)*N
Rancher's Fireweed *(Amsinckia menziesii var. menziesii)*N
Devil's Lettuce *(Amsinckia tessellata var. t.)***N
Alkali Heliotrope *(Heliotropium curassavicum)*N
Bracted Popcornflower *(Plagiobotrys bracteatus)*

MUSTARD FAMILY (*BRASSICACEAE*)
Black Mustard *(Brassica nigra)*
Hoary Cress *(Cardaria sp.)*
Contra Costa Wallflower *(Erysimum capitatum ssp. angustatum)**N(US & CA ENDANGERED/ CNPS 1B)
Summer Mustard *(Hirschfeldia incana)*
Wide-leaved Peppergrass *(Lepidium latifolium)*
Radish *(Raphanus sativus)*
Tumble Mustard *(Sisybrium altissimum)*
Oriental Sisybrium *(Sisybrium orientale)*

CACTUS FAMILY (*CACTACEAE*)
Prickly-pear Cactus *(Opuntia ficus-indica)*

HONEYSUCKLE FAMILY (*CAPRIFOLIACEAE*)
Blue Elderberry *(Sambucus mexicana)*N

PINK FAMILY (*CARYOPHYLLACEAE*)
Mouse-ear Chickweed *(Cerastium glomeratum)*
Windmill Pink *(Silene gallica)*
Sand-spurrey *(Spergularia rubra)*
Common Chickweed *(Stellaria media)*

(*CASUARINACEAE*)
Beefwood *(Casuarina sp.)*

GOOSEFOOT FAMILY (*CHENOPODIACEAE*)
Spearscale *(Atriplex triangularis)*N
Goosefoot *(Chenopodium murale)*
Russian Thistle *(Salsola tragus)*

MORNING GLORY FAMILY (*CONVOLVULACEAE*)
Hedge Morning-glory (Bindweed) *(Calystegia sepium ssp. limnophila)***N
Bindweed *(Convolvulus arvensis)*

STONECROP FAMILY (*CRASSULACEAE*)
Pygmyweed *(Crassula connata)*N
Pygmyweed *(Crassula tillaea)*

GOURD FAMILY (*CUCURBITACEAE*)
Man-root (Wild Cucumber) *(Marah fabaceus)*N

CYPRESS FAMILY (*CUPRESSACEAE*)
Cypress *(Cupressus sp.)*
Arbivitae *(Thuja sp.)*

DODDER FAMILY (*CUSCUTACEAE*)
Field Dodder *(Cuscuta pentagona)***N

SEDGE FAMILY (*CYPERACEAE*)
Sitka Sedge (*Carex aquatilis var. dives*)**N
Nebraska Sedge (*Carex nebrascensis*)**N
Sedge (*Carex sp.*)N
Tall Cyperus (Nutsedge) (*Cyperus eragrostis*)N
Common Tule (*Scirpus acutus var. occidentalis*)N
Three Square (*Scirpus americanus*)N
California Tule (Cali. Bulrush) (*Scirpus californicus*)N
Tule (Low Club Rush) (*Scirpus cernuus)***N

HORSETAIL FAMILY (*EQUISETACEAE*)
Smooth Scouring Rush (*Equisetum laevigatum*)N

SPURGE FAMILY (*EUPHORBIACEAE*)
California Croton (*Croton californicus*)**N

LEGUME FAMILY (*FABACEAE*)
Bird-of-paradise Bush (*Caesalpinia gilliesii*)
French Broom (*Genista monspessulana*)

Leather Root (*Hoita macrostachya*)**N
Delta Tule Pea (*Lathyrus jepsonii var. jepsonii*)*N (CNPS 1B)
Birdfoot Trefoil (*Lotus corniculatus*)
Spanish-clover (*Lotus purshianus var. purshianus*)N
Deerweed (*Lotus scoparius*)N
Stipulate Trefoil (*Lotus stipularis var. stipularis*)**N
Strigose Trefoil (*Lotus strigosus*)**N
Common Trefoil (*Lotus wrangelianus*)N
Silver Lupin (*Lupinus albifrons*)N
Dove Lupine (Dwarf Lupine) (*Lupinus bicolor var. pipersmithii*)**N
Dove Lupine (Dwarf Lupine) (*Lupinus bicolor var. umbellatus*)**N
Chamisso's Bush Lupine (*Lupinus chamissonis*)**N
Lupine (*Lupinus sp.*)N
Arroyo Lupine (*Lupinus succulentus*)N
Burr Clover (*Medicago polymorpha*)
Alfalfa (*Medicago sativa*)
White Sweetclover (*Melilotus alba*)
Yellow Sweetclover (*Melilotus indica*)
Black Locust (*Robinia pseudoacacia*)
Pin-point Clover (*Trifolium gracilentum*)N
Rose Clover (*Trifolium hirtum*)
Clover *(Trifolium sp.)*N
Tomcat Clover *(Trifolium willdenovii)*N
Common Vetch *(Vicia sativa ssp. nigra)*
Spring Vetch *(Vicia sativa ssp. sativa)*
Winter Vetch *(Vicia villosa ssp. varia)*
Winter Vetch *(Vicia villosa ssp. villosa)*

BEECH FAMILY (*FAGACEAE*)
Coastal Live Oak *(Quercus agrifolia)*N
Coastal Live Oak-Interior Live Oak Hybrid *(Quercus agrifolia var. wizliseni)*N
Valley Oak *(Quercus lobata)*

GENTIAN FAMILY (*GENTIANACEAE*)
Monterey Centaury *(Centaurium muehlenbergii)****N

GERANIUM FAMILY (*GERANIACEAE*)
Large-flowered Filaree *(Erodium botrys)*
Red-stemmed Filaree *(Erodium cicutarium)*
Cut-leaf Geranium *(Geranium dissectum)*

WATER-MILFOIL FAMILY (*HALORAGACEAE*)
Milfoil *(Myriophyllum sp.)*

WATERWEED FAMILY (*HYDROCHARITACEAE*)
Common Waterweed *(Elodea canadensis)*

IRIS FAMILY (*IRIDACEAE*)
Yellow Flag *(Iris pseudacorus)*

WALNUT FAMILY (*JUGLANDACEAE*)
N. Cali. Black Walnut *(Juglans californica var. hindsii)**N

RUSH FAMILY (*JUNCACEAE*)
Jointed Rush *(Juncus articulatus)***N
Baltic Rush *(Juncus balticus)*N

Toad Rush *(Juncus bufonius (var.?))*N
Bog Rush *(Juncus effusus)*
Irisleaf Rush *(Juncus xiphioides)?*N

ARROW-GRASS FAMILY (*JUNCAGINACEAE*)
Flowering Quillwort *(Lilaea scilloides)?*
Arrow-grass *(Triglochin sp.)*N

MINT FAMILY (*LAMIACEAE*)
Cutleaf Bugleweed *(Lycopus americanus)***N
Horehound *(Marrubium vulgare)*
Field mint *(Mentha arvensis)*
Mint *(Mentha sp.)*
Hoary Hedge-nettle (White Hedge-nettle) *(Stachys albens)***N
Vinegar Weed *(Trichostema lanceolatum)*N

LILY FAMILY (LILIACEAE)
Asparagus *(Asparagus officinalis ssp. o.)*
Blue Dicks *(Dichelostemma capitatum)*N

LOOSESTRIFE FAMILY (LYTHRACEAE)
California Loosestrife *(Lythrum californicum)***N

MALLOW FAMILY (MALVACEAE)
Lavatera *(Lavatera arborea)*
Cretican Tree-mallow *(Cretan lavatera) (Lavatera cretica)*
Cheeseweed *(Malva parviflora)*

(*MELIACEAE*)
Chinaberry *(Melia azedanach)*

MYRTLE FAMILY (*MYRTACEAE*)
Blue Gum *(Eucalyptus globulus)*

OLIVE FAMILY (*OLEACEAE*)
Oregon Ash *(Fraxinus latifolia)***N
Olive *(Olea europaea)*

EVENING-PRIMROSE FAMILY (*ONAGRACEAE*)
Contorted Primrose *(Camissonia contorta)?***N
Small-flowered Sun Cup (Small Primrose) *(Camissonia micrantha)?***N
Camissonia *(Camissonia sp.)*N
Elegant Clarkia *(Clarkia unguiculata)*N
Panicled Willowherb *(Epilobium brachycarpum)*N
Willowherb *(Epilobium ciliatum ssp. ciliatum)*N
Smooth Boisduvalia *(Epilobium pygmaeum)***N
Willowherb *(Epilobium sp.)*N
Water Primrose *(Ludwigia peploides)?***N
Antioch Dunes Evening Primrose *(Oenothera deltoides ssp. howellii)**N (US & CA ENDANGERED/CNPS 1B)
Hooker's Evening Primrose *(Oenothera elata ssp. hookeri)***N

OXALIS FAMILY (*OXALIDACEAE*)
Bermuda Buttercups *(Oxalis pes-caprae)*

POPPY FAMILY (*PAPAVERACEAE*)
California Poppy *(Eschscholzia californica)*N
Narrow-leaved Meconella *(Meconella linearis)***N
Wind Poppy *(Stylomecon heterophylla)*N

PLANTAIN FAMILY (*PLANTAGINACEAE*)
Crownfoot Plantain (Cutleaf Plantain) *(Plantago coronopus)*
English Plantain *(Plantago lanceolata)*
Mexican Plantain *(Plantago subnuda)***N

SYCAMORE FAMILY (*PLANTANACEAE*)
Western Sycamore *(Platanus racemosa)***N

GRASS FAMILY (*POACEAE*)
Spike Redtop *(Agrostis exarata)*N
Giant Reed *(Arundo donax)*
Slender Wild Oats *(Avena barbata)*
Wild oat *(Avena fatua)*
Bamboo *(Bambusa sp.)*
Ripgut Brome *(Bromus diandrus)*
Soft Brome *(Bromus hordeaceus)*
Red Foxtail Brome *(Bromus madritensis ssp. rubens)*
Pampas Grass *(Cortaderia selloana)*
Bermuda Grass *(Cynodon dactylon)*
Tufted Hairgrass *(Deschampsia cespitosa ssp. c.)***N
Tufted Hairgrass *(Deschampsia cespitosa ssp. holiciformis)?***N
Saltgrass *(Distichlis spicata)*N
Meadow Barley (Hordeum brachyantherum ssp. b.)N
Farmer's Foxtail (Hordeum murinum ssp. leporinum)
Farmer's Foxtail (Hordeum murinum ssp. m.)
Bristly Koeleria *(Koeleria phleoides)*
Alkali Rye (Creeping Ryegrass) *(Leymus triticoides)N*
Italian Ryegrass *(Lolium multiflorum)*
Witchgrass *(Panicum capillare)***N
Canary Grass *(Phalaris canariensis)*
Common Reed *(Phragmites australis)***N
Smilo Grass *(Piptatherum miliaceum)*
Kentucky Bluegrass *(Poa pratensis)*
Pacific Fescue *(Vulpia microstachys var. pauciflora)*N
Zorro Grass *(Vulpia myuros var. hirsuta)*
Zorro Grass *(Vulpia myuros var. m.)*

PHLOX FAMILY (*POLEMONIACEAE*)
Blue-headed Gilia (Range Gilia) *(Gilia capitata ssp. staminea)***N*

KNOTPLANT FAMILY (*POLYGONACEAE*)
Slender Buckwheat *(Eriogonum gracile var. g.)***N
Naked-stemmed Buckwheat *(Eriogonum nudum var. auriculatum)*N
Hairyflower Buckwheat *(Eriogonum nudum var. pubiflorum)***N
Willow Weed *(Polygonum lapathifolium)****N
Water Smartweed *(Polygonum punctatum)***N
Knotweed *(Polygonum sp.)*
Curly Dock *(Rumex crispus)*

PICKEREL-WEED FAMILY (*PONTEDERIACEAE*)
Water-hyacinth *(Eichornia crassipes)*

PURSLANE FAMILY (*PORTULACACEAE*)
Red Maids *(Calandrinia ciliata)*N
Miner's Lettuce *(Claytonia parviflora)*N
Miner's Lettuce *(Claytonia perfoliata)*N
Common Purslane *(Portulaca oleracea)*

ROSE FAMILY (*ROSACEAE*)
Toyon *(Heteromeles arbutifolia)*N
Silverplant *(Potentilla anserina ssp. pacifica)***N
Almond *(Prunus dulcis)*
Stone Fruit *(Prunus sp.)*
California Rose *(Rosa californica)*N
Himalayan Blackberry *(Rubus discolor)*
California Blackberry *(Rubus ursinus)*N

MADDER FAMILY (*RUBIACEAE*)
Button-willow *(Cephalanthus occidentalis var. californicus)***N
Goose Grass (Common Bedstraw) *(Galium aparine)*
Bedstraw *(Galium sp.)*

WILLOW FAMILY (*SALICACEAE*)
Fremont Cottonwood *(Populus fremontii ssp. fremontii)*N
Narrow-leaved Willow (Sandbar Willow) *(Salix exigua)*N
Arroyo Willow *(Salix lasiolepis)*N
Shining Willow *(Salix lucida ssp. lasiandra)****N

SAXIFRAGE FAMILY (*SAXIFRAGACEAE*)
Fringe Cups *(Tellima grandiflora)***N

SNAPDRAGON FAMILY (*SCROPHULARIACEAE*)
Cream Sacs *(Castilleja attenuata)*N
Purple Owlsclover *(Castilleja exserta (ssp.?))*N
Delta Mudwort *(Limosella subulata)*N (CNPS 2)
Yellow Monkeyflower *(Mimulus guttatus)*N
Purslane Speedwell *(Veronica peregrina ssp. xalapensis)*N

QUASSIA FAMILY (*SIMAROUBACEAE*)
Tree of Heaven *(Ailanthus altissima)*

NIGHTSHADE FAMILY (*SOLANACEAE*)
Thorn-apple (Tolguacha) (Datura wrightii)N
Tree Tobacco (Nicotiana glauca)
Blue Witch *(Solanum umbelliferum)*N

CATTAIL FAMILY (*TYPHACEAE/SPARGANIACEAE*)
Giant Burreed *(Sparganium eurycarpum or erectum)?*N
Narrow-leaved Cattail *(Typha angustifolia)*N
Southern Cattail *(Typha domingensis)*N

ELM FAMILY (*ULMACEAE*)
Dwarf Asiatic Elm *(Ulmus pumila)*

NETTLE FAMILY (*URTICACEAE*)
Dwarf Nettle *(Urtica urens)*

GRAPE FAMILY (*VITACEAE*)
Cultivated Grape *(Vitis vinifera)*

RARE PLANTS OF HISTORICAL OCCURRENCE
Hoover's Cryptantha *(Cryptantha hooveri)* (CNPS 4)*N
Small Spikerush *(Eleocharis parvula)* (CNPS 4)*N
Diamond-petaled Calif.Poppy *(Eschscholzia rhombipetala) (*CNPS 1B)*N
Contra Costa Goldfields *(Lasthenia conjugens)* (CA ENDANGERED/CNPS 1B)*N
Showy Madia *(Madia radiata)* (CNPS 1B)*N

N Native Species
* Rare, threatened or endangered in California. Special Plants List, July 2000, California Dept. of Fish and Game, Natural Diversity Database; and drafot of CNPS Inventory of Rare and Endangered Vascular Plants of California, Sixth ed, Due for publicaion 2001.

**Rare, thereatend or endangered in Alameda and Contra Costa counties. Listed in Unusaul and Significant Plants of Alameda and Contra Costa Counties, Dianne Lake, (CNPS, East ay Chapter, sixth ed, 2001).

***Watch List for Alameda anc Contra Costa counties. Unusual and Significant Plants of Alameda and Contra Costa Counites, Diane Lake, (CNPS, East Bay Chapter, six ed, 2001).

Appendix G
Bird List

Appendix G - Bird List for Antioch Dunes National Wildlife Refuge and Offshore Waters

Red-throated loon	(*Gavia stellata*)
Pied-billed grebe	(*Podilymbus podiceps*)
Western grebe	(*Aechmophorus occidentalis*)
Brown pelican	(*Pelecanus occidentalis*)
Double-crested cormorant	(*Phalacrocorax auritus*)
Black-crowned night-heron	(*Nycticorax nycticorax*)
Unknown egret	(*Egretta thula* or *Ardea alba*?)
Great blue heron	(*Ardea herodias*
Snow goose	(*Anser caerulescens*)
Canada goose	(*Branta canadensis*)
Mallard	(*Anas platyrhynchos platyrhynchos*)
Greater scaup	(*Aythya marila*)
Turkey vulture	(*Cathartes aura*)
Osprey	(*Pandion haliaetus*)
White-tailed kite	(*Elanus leucurus*)
Black kite	(*Milvus migrans*)
Marsh hawk (Northern harrier)	(*Circus cyaneus*)
Cooper's hawk	(*Accipiter cooperii*)
Red-tailed hawk	(*Buteo jamaicensis*)
American kestrel	(*Falco sparverius*)
Ring-necked pheasant	(*Phasianus colchicus*)
California quail	(*Callipepla californica*)
American coot	(*Fulica americana*)
Killdeer	(*Charadrius vociferus*)
Spotted sandpiper	(*Actitis macularia*)
Common snipe	(*Gallinago gallinago*)
Ring-billed gull	(*Larus delawarensis*)
Herring gull - North American	(*Larus argentatus smithsonianus*)
Caspian tern	(*Sterna caspia*)
Forster's tern	(*Sterna forsteri*)
Rock dove	(*Columba livia*)
Mourning dove	(*Zenaida macroura*)
Barn owl	(*Tyto alba*)
White-throated swift	(*Aeronautes saxatalis*)
Ruby throated hummingbird	(*Archilochus colubris*)
Anna's hummingbird	(*Calypte anna*)
Rufous hummingbird	(*Selasphorus rufus*)
Belted kingfisher	(*Ceryle alcyon*)
Nuttall's woodpecker	(*Picoides nuttallii*)
Red-shafted flicker	(*Colaptes cafer*)
Black phoebe	(*Sayornis nigricans*)
Western kingbird	(*Tyrannus verticalis*)
Loggerhead shrike	(*Lanius ludovicianus*)
Blue jay	(*Cyanocitta cristata*)
Western scrub-jay	(*Aphelocoma californica*)
American crow	(*Corvus brachyrhynchos*)
Common raven	(*Corvus corax*)
Violet-green swallow	(*Tachycineta thalassina*)
Cliff swallow	(*Petrochelidon pyrrhonota*)
Northern rough-winged swallow	(*Stelgidopteryx serripennis*)
Barn swallow	(*Hirundo rustica*)
Bushtit - coastal	(*Psaltriparus minimus minimus*)

Marsh wren	(*Cistothorus palustris*)
Ruby-crowned kinglet	(*Regulus calendula*)
American robin	(*Turdus migratorius*)
Northern mockingbird	(*Mimus polyglottos*)
European starling	(*Sturnus vulgaris*)
Water pipit	(*Anthus spinoletta*)
Cedar waxwing	(*Bombycilla cedrorum*)
Orange-crowned warbler	(*Vermivora celata*)
Yellow-rumped warbler	(*Dendroica coronata*)
Yellow-throated warbler	(*Dendroica dominica*)
Yellow warbler	(*Dendroica petechia*)
Rufous sided towheeSpotted	(*Pipilo maculatus*)
Song sparrow	(*Melospiza melodia*)
Fox sparrow	(*Passerella iliaca*)
White-crowned sparrow	(*Zonotrichia leucophrys*)
Dark-eyed junco	(*Junco hyemalis*)
Eastern meadowlark	(*Sturnella magna*)
Western meadowlark	(*Sturnella neglecta*)
Red-winged blackbird	(*Agelaius phoeniceus*)
Tri-colored blackbird	(*Agelaius tricolor*)
Brewer's blackbird	(*Euphagus cyanocephalus*)
Bullock's oriole	(*Icterus bullockii*)
Lawrence's goldfinch	(*Carduelis lawrencei*)
Pine siskin	(*Carduelis pinus*)
Lesser goldfinch	(*Carduelis psaltria*)
American goldfinch	(*Carduelis tristis*)
House finch	(*Carpodacus mexicanus*)

Appendix H
Fish List

Appendix H - Fish Species Found Offshore of Antioch Dunes National Wildlife Refuge

American shad	*(Alosa sapidissima)*
Yellowfin goby	*(Acanthogobius flavimanus)*
Sacramento sucker	(*Catostomus occidantalis*)
Prickly sculpin	*(Cottus asper) (Richardson)*
Shiner surfperch	(*Cymatogaster aggregata)*
Threadfin shad	*(Dorosoma petenense)*
Sculpin family	(Family Cottidae)
Goby family	(Family Gobiidae)
Western mosquitofish	(*Gambusia affinis)*
Threespine stickleback	(*Gasterosteus aculeatus)* (Linnaeus)
Delta smelt	*(Hypomesus transpacificus)*
Tule perch	*(Hysterocarpus traski)* (Gibbons)
Hitch	(*Lavinia exilicauda)*
Bluegill	*(Lepomis macrochirus)*
Redear sunfish	*(Lepomis microlopus)*
Pacific staghorn sculpin	(*Leptocottus armatus)* (Girard)
Rainwater killifish	*(Lucania parva)*
Inland silverside	(*Menidia beryllina)*
Largemouth bass	*(Micropterus salmoides)*
Striped bass	*(Morone saxatilis)*
Hardhead	*(Mylopharodon conocephalus)*
Golden shiner	(*Notemigonus crysoleucas)*
Rosyface shiner	*(Notropis rubellus)*
Steelhead trout	(*Oncorhynchus mykiss)*
Chinook salmon	*(Oncorhynchus tshawytscha)*
Sacramento blackfish	(*Orthodon microlepidotus)* (Ayres)
Bigscale logperch	*(Percina macrolepida)* (Stevenson)
Starry flounder	*(Platichthys stellatus)*
Sacramento splittail	*(Pogonichthys macrolepidotus)*
Sacramento squawfish	(*Ptychocheilus grandis) (*Ayres*)*
Logfin smelt	*(Spirinchus thaleichthys*) (Ayres)
Goby shimofuri	*(Tridentiger bifasciatus)*
Chameleon goby	*(Tridentiger trigonocephalus)*
Unknown Bass	

Appendix I
Insect List

Appendix I- Insect List for Antioch Dunes National Wildlife Refuge

Invertebrates observed or collected (1/95 - 6/97)
Arranged alphabetically for ease of reference

Order Coleoptera (Beetles)

Family Alleculidae
Lopopoda sp.

Family Anthicidae
Anthicus biguttulus
*Formicilla sp. **

Family Buprestidae
*Acmaeodera sp.**
Agrilus sp.

Family Carabidae
Agonoderus sp.
Agonum marginicolle
Amara sp.
Harpalus sp. @
Pterostichus sp. @
Scaphinotus striatopunctatus @
Stenolophus maculatus

Family Chrysomelidae
Altica lasulina
Diabrotica undecimpunctata
Monoxia consputa @

Family Coccinellidae
Coccinella californica
Coccinella septempunctata
Hippodamia convergens
Hipopodamia quinquesignata
Olla v-nigrum
Psyllobora vigintimaculata
*Stethorus puntum picipes **
Undetermined taxa

Family Curculionidae
Apion proclive
Paragoges maculata
*Sphenophorus aequalis **
Tychius sp. @
Undetermined taxa

Family Dermestidae
Anthrenus sp. @

Family Dytiscidae
*Colymbetes sp. **
Laccophilus decipiens
Thermonectus basillaris

Family Elateridae
*Agriotes sp. **
Euthysanius sp.

Family Heteroceridae
Heterocerus sp.
*Orthellia caesarion **

Family Hydrophilidae
Enochrus diffusus
Tropisternus lateralis
Tropisternus sp.

Family Meloidae
*Lytta sp. **
Nemognatha lurida apicalis

Family Scarabaeidae
Aphodius sp. @
Coenonycha sp.
Cyclocephala sp.
Plectrodes pubescens @
Polyphylla stellata
*Serica anthracina **

Family Tenebrionidae
Amphidora littoralis @
Blapstinus sp. @
Coniontis sp.
Eleodes sp.
Eulabis bicarinata
Nyctoporis sp. @

Order Dermaptera (Earwigs)

Family Forficulidae
Forficula auricularia

Order Diptera (Flies)

Family Anthomyiidae
Adia cinerella

Family Anthomyzidae
Anthomyza sp. @

Family Apioceridae
*Apiocera chrysolasia **

Family Asilidae
Asilus sp.
*Efferia albibarbis**
*Efferia antiochi **
*Efferia cana**
*Stenopogon breviusculus **
*Stenopogon obscuriventris *@*

Family Bibionidae
Bibio albipennis *

Family Bombyliidae
Aphoebanius sp. *
Bombylius sp. *
Hemipenthes sp. *
Thyridanthrax sp. *
Toxophora sp. *
Villa sp.
Undetermined taxon

Family Calliphoridae
Eucalliphora lilaea
Phaenicia serricata

Family Cecidomyiidae
Cordylomyia sp. *

Family Chironomidae
Chironomus decorus
Chironomus staegeri
Hydrobaenus sp.
Procladius sp. *
Symbiocladius equitans @

Family Conopidae
Physocephala texana *
Physoconops fronto

Family Culicidae
Aedes washinoi @
Culex erythrothorax @
Culex tarsalis
Culiseta incidens
Culiseta inornata
Culiseta particeps @

Family Dolichopodidae
Dolichopus sp. @
Hydrophorus sp. @
Medetera sp. @

Family Empididae
Platypalpus sp. *

Family Ephydridae
Mosillus sp.

Family Helcomyzidae
Pseudoleria sp. *
Suillia limbata @

Family Muscidae
Musca domestica

Family Mycetophilidae
Mycomya sp.

Family Otitidae
Ceroxys latiusculus *

Family Sarcophagidae
Euphytomima sp.
Liopygia sp. *
Ravinia sp. @

Family Scathophagidae
Scathophaga sp. @

Family Sepsidae
Sepsis sp. @

Family Simuliidae
Metacnephia sp.

Family Sphaeroceridae
Leptocera fontinalis @
Leptocera (Rachispoda) sp.

Family Syrphidae
Epistrophe sp.
Eristalinus aeneus
Eristalis sp.
Helophilus latifrons @
Paragus tibialis
Platycheirus sp. @
Syritta pipiens

Family Tabanidae
Chrysops coloradensis *

Family Tachinidae
Archytas apicifer *
Cylindromyia sp. @
Gonia sp. *
Gymnosoma sp. *
Tachina sp. @

Family Tephritidae
Dioxnya sororcula @
Tephritis californica @

Family Therevidae
Acrosathe sp. *

Family Tipulidae
Tipula californica @
Tipula sp. *

Order Hemiptera (True Bugs)

Family Alydidae
Alydus sp. *

Family Berytidae
Jalysus sp. @

Family Corixidae
Corisella decolor
Trichocorixa reticulata

Family Cydnidae
Microporus testudinatus @

Family Lygaeidae
Eremocoris sp. *
Geocoris niger @

Geocoris sp. @
*Lygaeus kalmii **
Neocoryphus bicrucis
Nyssius sp.

Family Miridae
Adelphocoris superbus @
Irbisia californica
Lopidea sp.
Lygus hesperus

Family Nabidae
Nabis sp. @

Family Pentatomidae
*Chlorochroa ligata **
*Chlorochroa sayi **
Murgantia histrionica

Family Rhopalidae
*Arhyssus sp. **

Family Saldidae
Saldula pallipes @

Order Homoptera (Cicadas, Hoppers, etc)

Family Cicadellidae
Undetermined taxa

Family Cicadidae
*Okanagana sp. **

Family Dictyopharide
Scolops sp.

Family Membracidae
Undetermined taxa @

Order Hymenoptera (Bees, Wasps & Ants)

Family Andrenidae
Andrena sp.
*Perdita sp. **

Family Anthophoridae
Anthophora sp.
Melissodes sp.
*Nomada sp. **
Zacosmia maculata maculata

Family Apidae
Apis mellifera
Bombus sonorensis
Bombus vosnesenskii
Xylocopa brasilianorum @

Family Argidae
*Sterictophora sp. **

Family Braconidae
Undetermined taxa

Family Chalcididae
Undetermined taxon

Family Chrysididae
*Argochrysis mesillae **
*Chrysis lucidera **
*Chrysis vagabunda **
*Hedychridium fletcheri **
*Hedychrum boharti **
*Parnopes edwardsi **

Family Colletidae
Colletes sp. @

Family Eumenidae
Undetermined taxon

Family Halictidae
*Agapostemon sp. **
*Dieunomia nevadensis angelisis **
*Halictus sp. **
Lassioglossum sp.
*Sphecodes sp. **

Family Ichneumonidae
Diplazon laetatorius @
Ophion sp. @
Undetermined taxa

Family Megachilidae
*Anthidiellum notatum robertsoni **
*Anthidium utahense **
Ashmeadiella sp.
*Megachile sp. **
*Osmia sp. **

Family Mutillidae
Dasymutilla abdita
Dasymutilla aureola pacifica @
Dasymutilla coccineohirta
*Dasymutilla flammifera **
Dasymutilla sackeni
Sphaerophthalma sp.

Family Pompilidae
*Anoplius cleora **
*Anoplius nigritis **
*Aporinellus completus **
*Sericopompilus neotropicalis **
*Tachypompilus unicolor unicolor **
Undetermined taxa

Family Sphecidae
Ammophila sp.
*Bembix americana comata **
Bembix occidentalis
*Bicyrtes ventralis **
*Cerceris californica **
*Cerceris finitima **
*Cerceris frontata **
Cerceris vanduzeei
*Chalybion californica **
*Dryudella sp. **

Clypeadon californica *
Isodontia elegans *
Philanthus multimaculatus *
Philanthus pacifica *
Podalonia luctuosa *
Prionyx sp. *
Sphex lucae
Sphex pennsylvanica *
Steniolia scolopacea *
Undetermined taxa

Family Tenthredinidae
Tenthredo sp. *

Family Tiphiidae
Paratiphia nevadensis *

Family Vespidae
Mischocytarus flavitarsus @
Polistes apachus *
Polistes fuscatus aurifer
Vespula pennsylvanica
Undetermined taxa

Order Lepidoptera (Butterflies & Moths)

Family Arctiidae
Apantesis proxima *
Estigmene acraea *

Family Danaidae
Danaus plexippus

Family Hesperiidae
Hylephila phyleus
Pholisora cantullus *
Pyrgus communis

Family Lycaenidae
Callophrys affinis perplexa
Everes amyntula *
Plebejus acmoni
Strymon melinus

Family Noctuidae
Caenurgina crassiuscula
Syneda sp. @
Trichoplusia ni @

Family Nymphalidae
Coenonympha californica
Nymphalis antiopa
Phyciodes mylitta
Precis coenia
Vanessa carye

Family Papilionidae
Papilio zelicaon

Family Pieridae
Colias eurytheme
Euchloe ausinoides
Pieris rapae
Pieris protodice

Family Riodinidae
Apodemia mormo langei

Family Sphingidae
Proserpinus clarkiae *

Order Neuroptera (Lacewings, Antlions, etc)

Family Hemerobiidae
Sympherobius sp. @

Family Myrmeleontidae
Brachynemurus pregrinus

Family Raphidiidae
Agulla sp. *

Order Odonata (Dragonflies & Damselflies)

Family Aeschnidae
Aeshna multicolor
Anax junius

Family Coenagrionidae
Enallagma carunculatum
Enallagma civile

Family Libellulidae
Pachydiplax longipennis *
Tarnetrum costiferum
Tramea sp.

Order Orthoptera (Crickets, Roaches, etc)

Family Acrididae
Melanoplus cinereus dealbatus *
Trimerotropis pallidipennis

Family Gryllacrididae
Ceuthophilus sp. @
Stenopelmatus sp. @

Family Mantidae
Iris oratoria *

Family Phasmatidae
Parabacillus hesperus *

Family Polypagidae
Arenivaga sp. @

Spiders, Scorpions, Wind Scorpions, Centipedes, Millipedes and Isopods have not yet been identified.

Many small bees, wasps and ants have yet to be determined. A few small beetles are also unidentified.

It is estimated that approximately 260 different kinds of insects have currently been collected from the refuge.

The microlepidoptera have essentially been ignored Because of the detailed studies performed by Jerry Powell. Their current status may need to be considered.

* indicates collection or observation of taxon at the Stamm Parcel.

@ indicates collection or observation of taxon at the Sardis Parcel.

No symbol by a taxon indicates that it was found at both refuge parcels.

Appendix J
Fire Management Plan

WILDLAND FIRE MANAGEMENT PLAN

ANTIOCH DUNES NATIONAL WILDLIFE REFUGE

2002

JANUARY 2002

WILDLAND FIRE MANAGEMENT PLAN

ANTIOCH DUNES NATIONAL WILDLIFE REFUGE

Prepared: Roger P. Wong — 1/3/02
Roger Wong — Date
Fire Management Officer
San Luis NWRC

Margaret J. Kolar — 12/27/01
Margaret Kolar — Date
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Concurred: Pam Ensley — 1/10/02
Pam Ensley — Date
Regional Fire Management Coordinator
Pacific Region, US Fish and Wildlife Service

Approved: Steve Thompson — 2/15/2002
Steve Thompson — Date
California/ Nevada Operations Manager
Pacific Region, US Fish and Wildlife Service

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EXECUTIVE SUMMARY

When approved, this document will become the Antioch Dune National Wildlife Refuge fire management plan. Major components include:

- ♦ updated policy for prescribed fires at Antioch Dunes National Wildlife Refuge.
- ♦ format changes under the direction of Fire Management Handbook (Release Date 6/1/00).

This plan is written to provide guidelines for appropriate suppression and prescribed fire programs at Antioch Dunes National Wildlife Refuge. Prescribed fires may be used to reduce hazard fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species, and/or conduct research.

INTRODUCTION

The 55-acre Antioch Dunes National Wildlife Refuge (Refuge) and adjacent 12-acre Pacific Gas and Electric (PG&E) land support the last remaining populations of three endangered species including the Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howellii*), Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*), and the Lange's metalmark butterfly (*Apodemia mormo* ssp. *langei*). The primary objective of the Refuge is to provide habitat for these three endemic endangered species. Historically, many factors have contributed to the decline of these species, including human development and sand mining of the dunes. Currently the primary threat to these species is the stabilization of the dunes and the subsequent encroachment of non-native vegetation such as rip-gut brome grass (*Bromus diandrus*) and yellow starthistle (*Centaurea solstitialis*).

The Fire Management Plan (FMP) for Antioch Dunes National Wildlife Refuge will help achieve resource management objectives by using prescribed fire to control non-native vegetation for the restoration of native riverine sand dune habitat. The Department of the Interior policy requires that all refuges with vegetation that can sustain fire must have a Fire Management Plan that details fire management policies, the use of prescribed fire for attaining resource management objectives, and fire program operational procedures. This plan meets NEPA/NHPA compliance (See Appendix C).

This plan is written as an operational guide for managing the refuge's wildland fire and prescribed fire programs. It defines levels of protection needed to ensure safety, protect facilities and resources, and restore and perpetuate natural processes, given current understanding of the complex relationships in natural ecosystems. It is written to comply with a service-wide requirement that refuges with burnable vegetation develop a fire management plan (620 DM 1).

There is no dedicated fire staff at Antioch Dunes NWR or San Francisco Bay NWRC. All wildland fires will be suppressed by local cooperating agencies (Contra Costa Fire Protection District) with the oversight of the Project Leader and Zone Fire Management Officer (FMO). All prescribed fires will be coordinated through the Zone FMO.

COMPLIANCE WITH USFWS POLICY

The Refuge was established in 1980 under the authority of the Endangered Species Act to preserve and protect two endangered plants, the Antioch Dunes evening-primrose and the Contra Costa wallflower, and an endangered butterfly, the Lange's metalmark butterfly. The primary management objective of the Refuge is to provide the necessary habitat for these and other native species through restoring native riverine sand dune habitat and controlling non-native vegetation.

This FMP specifically addresses the use of prescribed fire for resource management purposes.

The objectives of the Refuge are to protect and restore riverine sand dune habitat for the three endangered species and other native dune species. Several operational plans are used by the Refuge to meet these objectives, including a recovery plan for the three endangered species, multiple internal Section 7 endangered species consultations, and an environmental assessment for the Refuge. The plans that currently apply to Fire Management include the Internal Section 7 Consultation for Prescribed Burning (Appendix D), Environmental Assessment (EA) for Prescribed Burning (Appendix C), the Prescribed Fire Plan (Appendix E), and the 1984 Fire Management Plan with 1997 Prescribed Burning Addendum.

The FMP is a detailed program of action to implement fire management policies and objectives, and addresses policy on prescribed burning to control non-native vegetation and restore native riverine sand dune habitat. The FMP meets the objectives of the Refuge's operational plans by supporting strategies which rely upon fire as a management tool and by identifying where and when fire is not wanted.

The Department Manual, DM 910 (USDI 1997) states the following regarding wildland fires:

> "Wildfires may result in loss of life, have detrimental impacts upon natural resources, and damage to or destruction of man-made developments. However, the use of fire under carefully defined conditions is to be a valuable tool in wildland management. Therefore, all wildfires within the Department will be classified either as wildfire or as prescribed fires.
>
> Wildfires, whether on lands administered by the Department or adjacent thereto, which threaten life, man-made structures, or are determined to be a threat to the natural resources or the facilities under the Department's jurisdiction, will be considered emergencies and their suppression given priority over normal Departmental programs.
>
> Bureaus will give the highest priority to preventing the disaster fire - the situation in which a wildfire causes damage of such magnitude as to impact management objectives and/or socio-economic conditions of an area. However, no wildfire situation, with the possible exception of threat to human survival, requires the exposure of firefighters to life threatening situations. Within the framework of management objective and plans, overall wildfire damage will be held to the minimum possible giving full consideration to (1) an aggressive fire prevention program; (2) the least expenditure of public funds for effective suppression; (3) the methods of suppression least damaging to resources and the environment; and (4) the integration of cooperative suppression actions by agencies of the Department among themselves or with other qualified suppression organizations.

> "Prescribed fires...may be used to achieve agency land or resource management objectives as defined in the fire management plans....Prescribed fires will be conducted only when the following conditions are met:
>
> a. Conducted by qualified personnel under written prescriptions.
> b. Monitored to assure they remain within prescription.
>
> Prescribed fires that exceed the limits of an approved prescribed fire plan will be reclassified as a wildfire. Once classified a wildfire, the fire will be suppressed and will not be returned to prescribed fire status."

The authority for funding (normal fire year programming) and all emergency fire accounts is found in the following authorities:

> Section 102 of the General Provisions of the Department of Interior's annual Appropriations Bill provides the authority under which appropriated monies can be expended or transferred to fund expenditures arising from the emergency prevention and suppression of wildland fire.
>
> P.L. 101-121, Department of the Interior and Related Agencies Appropriation Act of 1990, established the funding mechanism for normal year expenditures of funds for fire management purposes.
>
> 31 US Code 665(E)(1)(B) provides the authority to exceed appropriations due to wildland fire management activities involving the safety of human life and protection of property.

Authorities for procurement and administrative activities necessary to support wildland fire suppression missions are contained in the Interagency Fire Business Management Handbook.

The Reciprocal Fire Protection Act of May 27, 1955 (42 USC 815a; 69Stat 66) provides Authorities to enter into agreements with other Federal bureaus and agencies; with state, county, and municipal governments; and with private companies, groups, corporations, and individuals regarding fire activities. Authority for interagency agreements is found in "Interagency Agreement between the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, US Fish and Wildlife Service of the United States Department of the Interior and the Forest Service of the United States Department of Agriculture" (1996).

FIRE MANAGEMENT OBJECTIVES

Wildland fires probably did not occur very frequently on the historic dunes because they were much more sparsely vegetated than present day. Due to the ecology of the area, the sensitivity of the habitat, and the proximity of developed areas, all wildland fires will be suppressed. Prescribed fire will be used to reduce hazardous fuels, control non-native vegetation, prepare sites for seeding and planting, and enhance conditions for native dune species.

The Fire Management Objectives for this Refuge are:

1. Firefighter and public safety top priority. All Fire Management activities will reflect this commitment.

2. Integrate prescribed fire management actions with other management activities to provide for the protection, restoration and enhancement of native dune species. Wildland fire management actions will be consistent with personnel safety and resource protection objectives.

3. Actively suppress and prevent the occurrence of wildland fire that could seriously jeopardize populations of endangered species.

4. Protect important local resources and private lands from fire.

DESCRIPTION OF REFUGE

The Refuge is located along the southern shore of the lower San Joaquin river near the city of Antioch, Contra Costa County, California (Figure 1). The Refuge lies within an ecoregion described by Bailey (1995) as the Mediterranean Division, California Dry Steppe Province. Historically, the Antioch Dunes extended over two miles along the southern bank of the San Joaquin river and reached heights of 117 feet. The 55-acre Refuge was extensively mined for sand in the past and subsequently ranges in elevation from 0 to 50 feet. The Refuge currently exists as isolated habitat, surrounded by industrial development.

The Antioch area has a modified Mediterranean climate with warm to hot dry summers and moist, mild winters. Rainfall averages 12.53 inches annually, falling mainly during November-April. The average annual temperature is 61.8 degrees F with an average annual maximum temperature of 74 degrees F and an average annual minimum temperature of 47 degrees F. The hottest recorded temperature is 114 degrees F, and the lowest recorded temperature is 14 degrees F. Winds in the summer come off the river from the west or northwest at an average of 10-20 mph.

The Refuge is split into two units: Sardis and Stamm. Soils in the Refuge are representative of the Oakley sands interlaced with alluvial fan deposits. The Sardis Unit (14 acre eastern parcel) was mined down to a clay/peat substrate for the most part and subsequently some sand was replaced over many of these areas. The perimeter still consists of sandy loam substrate. The Stamm Unit (41 acre western parcel) was also mined down to a "hard pan" layer of varying thickness, but underneath this hard pan is sandy loam. Sand was replaced over a small portion of the mined area on the Stamm Unit as well.

The Sardis Unit is bordered by Wilbur Avenue on the South, the San Joaquin River on the North, and PG&E on the East and West. The Stamm Unit is bordered by Fulton Shipyard to the West, Fulton Shipyard Rd. to the Southwest, The City of Antioch Public Works Disposal Site and Burlington Northern Railroad to the South, and Georgia Pacific Gypsum to the East.

CULTURAL RESOURCES

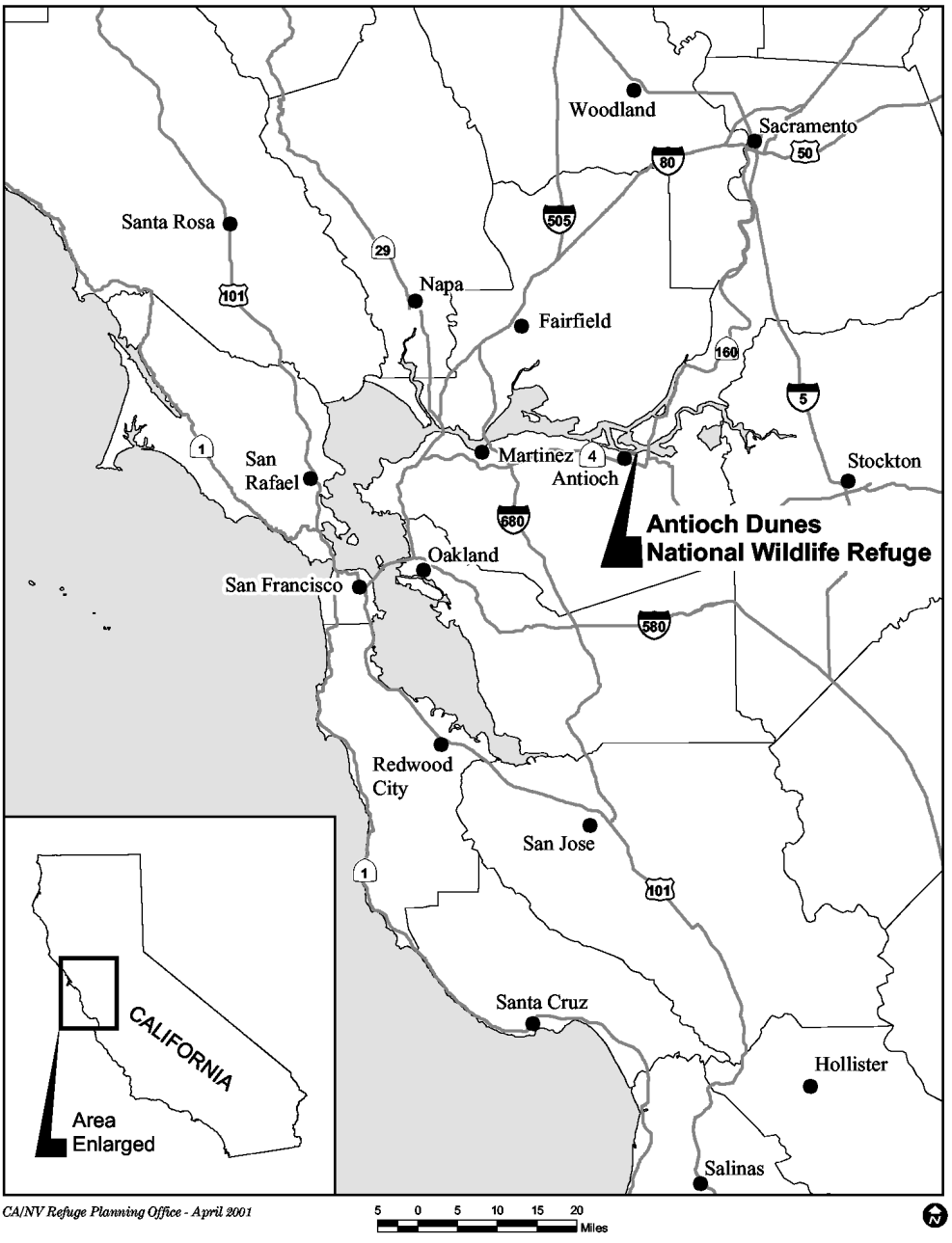
Under Federal ownership, archaeological and historical resources within the Refuge receive protection under Federal laws mandating the management of cultural resources, including, but not limited to, the Archaeological Resources Protection Act; the Archaeological and Historical Preservation Act; the Native American Graves and Repatriation Act, and the National Historic Preservation Act of 1966. The Refuge has obtained Section 106 Compliance Permit (May 28, 1997; Appendix C).

Evidence of native settlements and Spanish exploration of the area has been documented. A native village is thought to have been located within the present-day Antioch area. The area was traveled and used by settlers for residence, grazing, and recreation. Railroad spurs and sand removal from the dunes (now located within the refuge) began in the 1890s.

Little evidence of human activity remains on the refuge due to the extensive sand mining that occurred until the early 1900's. Cultural artifacts can still be found among what remains of the leveled dunes. The refuge was used as a de facto garbage dump during the mining era.

FIGURE 1: VICINITY MAP

Figure 1. Location Map



Fish and Wildlife

The Refuge lands support the last remaining populations of the Lange's metalmark butterfly (*Apodemia mormo* ssp. *langei*). The primary objective of the Refuge is to provide habitat for this endemic endangered species. Historically, many factors have contributed to the decline of the species, including human development and sand mining of the dunes.

The Refuge provides important habitat for many types of wildlife including nesting and migratory birds and the California legless lizard. In recent times, eight species of reptiles and no amphibians were identified on the refuge. Recent observations of mammals have been limited but include gopher, gray fox, red fox, coyote, Beechy ground squirrel, black-tailed jack rabbit, and muskrat. Bird species include Anna's hummingbird, western meadowlark, scrub jay, cedar waxwing, red-shafted flicker, belted kingfisher, northern rough-winged swallow, and other migratory and resident birds.

Federally listed or proposed fish species occurring in the waters adjacent to the Refuge include winter-run chinook salmon, delta smelt, steel-head trout, and Sacramento splittail. Surveys on the refuge have identified nearly 400 species of invertebrates. Changes in invertebrate species composition have been linked to changes in vegetation and the increase in weedy species.

VEGETATION

Six main habitat types are found within the 55-acre Refuge: littoral, riparian, open sand dunes, abandoned vineyard, disturbed/mined areas and grassland areas. The littoral zone contains a state listed rare plant: Mason's lilaeopsis (*Lilaeopsis masonii*). The riparian area is characterized by native species such as, but not limited to, coast live oak (*Quercus agrifolia*), red willow (*Salix laevigata*), narrow-leaved willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*), California toyon (*Heteromeles arbutifolia*) and elderberry (*Sambucus mexicana*). The open dune areas consist of native species including: Antioch dunes evening primrose, Contra Costa wallflower (both federally listed as endangered), naked-stemmed buckwheat, host plant for the endangered Lange's metalmark butterfly, telegraph weed (*Heterotheca grandiflora*), *Senecio flaccidus* var. *douglasii*, deerweed (*Lotus scoparius*) and many others, as well as non-native grasses and other non-native species (Appendix C). In the disturbed, grassland, and vineyard areas there is an abundance of non-native species including vetch (*Vicia* spp.), rip-gut brome grass, yellow starthistle, and Russian thistle (*Salsola tragus*), as well as some native species.

The Refuge and adjacent 12-acre Pacific Gas and Electric (PG&E) land support the last remaining populations of two endangered plant species, the Antioch Dunes evening primrose *(Oenothera deltoides ssp. howellii*) and the Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*). The primary objective of the Refuge is to provide habitat for these endemic endangered species. Historically, many factors have contributed to the decline of these species, including human development and sand mining of the dunes. Currently the primary threat to these species is the stabilization of the dunes and the encroachment of non-native vegetation such as rip-gut brome grass (*Bromus diandrus*), yellow starthistle (*Centaurea solstitialis*), and vetch (*Vicia villosa*).

STRUCTURES AND FACILITIES

There are no buildings of any kind within the Refuge boundaries. However, on the Stamm Unit, the City of Antioch maintains a sewage outfall structure to the San Joaquin River. The refuge is also surrounded by industrial plants.

WILDLAND FIRE MANAGEMENT SITUATION

HISTORIC ROLE OF FIRE

The majority of the habitat on both units of the Refuge are highly susceptible to wildland fire. The dominant vegetation is composed of annual grasses and scattered brush. These fuels are highly flammable and would result in a high rate of spread should a wildland fire occur. The predominant, strong, northwest winds combined with the usual low humidity and high temperature during the summer would aid the spread and intensity of a fire. Fire ignitions within the Refuge boundaries occur after curing of annual grasses and prior to normal beginning of fall precipitation (May - October; Loredo pers. comm. 2001)

Pre-settlement Fires

The history of fire in the area is not well known. It could be assumed that since the area is situated so close to the water's edge and the vegetation was much sparser than it currently is, that there were few wildland fires. There is little information regarding Native American use of fire in the area.

Post-settlement Fire History

There is an extensive history of unplanned fires at the Refuge. The Refuge was originally open to the public, but due to the large amount of fires that were started by users, the Refuge was closed and subsequent unplanned fire frequency decreased. Table 1 is a complete history of fire at Antioch Dunes NWR since it's establishment in 1980.

Table 1: Fire History

Unit	Date	Location	Acres	Type	Cause
Stamm	6/01	Hardpan #1	3	Prescribed	
Stamm	6/01	Vineyard area along RR	8	Prescribed	
Stamm	6/00	Hardpan #1	3	Prescribed	
Stamm	6/00	Vineyard area along RR	8	Prescribed	
Stamm	6/99	Triangle Unit near gate	3	Prescribed	
Stamm	6/99	Vineyard area along RR	8	Prescribed	
Stamm	6/99	Hardpan #1	3	Prescribed	
Stamm	5/99	Hardpan #1 near water	<1	Wildland fire	industrial
Stamm	5/99	Hardpan/ NE	18	Wildland fire	Escaped illegal campfire
Stamm	6/98	Triangle Unit near gate	3	Prescribed	
Stamm	6/98	Vineyard area along RR	5	Prescribed	
Stamm	10/97	NE Corner along river	1.0	Wildland fire	Escaped illegal campfire
Stamm	6/17/97	Triangle unit near gate	3	Prescribed	

Stamm	6/16/97	Vineyard area along RR	5.0	Prescribed	
Stamm	7/6/96	SE Corner near RR	.1	Wildland fire	Unknown
Stamm	10/31/90	Along railroad track	7.0	Wildland fire	Potential Arson
Stamm	12/31/90	Near river next to blowout	2.0	Wildland fire	Unknown
Stamm	3/28/88	Along river - west side	.5	Wildland fire	Campfire
Stamm	6/24/87	Triangle Unit near gate	3.0	Wildland fire	Fireworks
Stamm	6/7/85	Between river and access road, west end	10.0	Wildland fire	Unknown-suspicious
Sardis	6/99	South Plateau near gate	4.25	Prescribed	
Sardis	6/98	South Plateau near gate	4.25	Prescribed	
Sardis	6/16/97	South Plateau near gate	4.25	Prescribed	
Sardis	6/25/90	Along Wilbur, Little Corral Parking area.	3.0	Wildland fire	Unknown
Sardis	7/21/89	East of entrance gate along fence	.1	Wildland fire	Unknown
Sardis	7/21/88	West of entrance gate along fence	.2	Wildland fire	Cigarette from highway?
Sardis	6/5/85	West of entrance gate along fence	3.0	Wildland fire	Unknown -suspicious
Sardis	9/30/84	N. of old parking lot	1.0	Wildland fire	Unknown
Sardis	8/12/84	Near river against PG&E east boundary	1.5	Wildland fire	Unknown
Sardis	7/12/84	Beach fire	.1	Wildland fire	Unattended campfire
Sardis	5/10/84	East of gate onto PG&E east	2.5	Wildland fire	Arson
Sardis	7/5/83	Unknown	.1	Wildland fire	Staff caused-welding
Sardis	7/23/82	SE corner of pit area	2.25	Wildland fire	Unknown-suspicious
PG&E	3/3/85	Center of East Unit	.5	Wildland fire	Unattended campfire
PG&E	10/9/84	East Unit trees near river	.25	Wildland fire	Unknown
PG&E	6/18/84	East Unit around tower	1.0	Wildland fire	Downed electric line

Prescribed Fire History

The prescribed burn program began in 1997 to manage non-native species. Table 1 above shows dates of past prescribed burns.

RESPONSIBILITIES

Antioch Dunes NWR does not have an onsite fire management staff or suppression equipment. There is a Service fire crew stationed part-time (late spring to early fall) at San Luis NWRC and "collateral duty" Refuge personnel stationed at San Francisco Bay NWRC. Both of these sites are approximately 90 miles from the Refuge. Wildland fires in this area are generally reported by the public and suppressed by firefighters from the Contra Costa County Fire Protection District (FPD) before Service staff can respond.

Responsibilities for fire management at Antioch Dunes are shared by: the Antioch Dunes Refuge Manager, Refuge Biologist, San Francisco Bay NWR Complex Project Leader, and the Zone Fire Management Officer stationed at San Luis NWRC (Appendix F-Fire Dispatch Plan for further detail). Primary wildland fire management responsibilities are:

- develop and cultivate working relationships with local fire departments in the area that can provide mutual aid
- maintain firebreaks on Refuge to prevent wildland fire
- conduct prescribed fire activities in support of refuge habitat management programs
- establish and maintain appropriate fire related agreements/contracts
- monitor results of wildland and prescribed fires
- update fire management and associated plans (dispatch, training, etc.), call-out lists, and mobilization guidelines, air quality certifications.
- continue to develop a cadre of "red-carded" firefighters for wildland fire, trained and equipped to accomplish the fire management program
- maintain the refuge fire cache and fire equipment in a ready state

Agency Administrator/ Project Leader (PL)

- Is responsible for implementation of all Fire Management activities within the Complex and will ensure compliance with Department, Service and refuge policies.
- Selects the appropriate management responses to wildland fire.

Deputy Project Leader (DPL)

- Coordinates Complex programs to ensure personnel and equipment are made available and utilized for fire management activities including fire suppression, prescribed burning and fire effects monitoring.
- Ensures that the fire management program has access to Refuge and complex resources when needed.
- Ensures that Refuge Managers and complex Staff consider the fire management program during Refuge related planning and implementation.

Refuge Manager (RM)

- Identifies prescribed burn units and biological objectives to Fire Management Officer (FMO) and Prescribed Fire Specialist (PFS), notifies FMO of prescribed fire project

constraints, and ensures that Refuge resources are available to accomplish prescribed fire and fire suppression objectives.

- Acts as the primary Refuge Resource Management Specialist during fire management planning and operations.
- Prepares an annual report detailing fire occurrences and prescribed fire activities undertaken in each calendar year. This report will serve as a post-year's fire management activities review, as well as provide documentation for development of a comprehensive fire history record for the Refuge.
- Is responsible for planning, coordinating, and directing preparedness activities including fire training, physical fitness testing and Interagency Fire Qualification System (IFQS) data entry, fire cache and equipment inventory accountability, maintenance, and operation, cooperation with cooperative agencies.

Biologist

- Coordinates through Refuge Managers and Deputy Project Leader to provide biological input for the fire program with the FMO and PFS.
- Ensures fire effects monitoring is being implemented and drafts wildland fire Rehabilitation Plans for Deputy Project Leader.
- Assists in design and implementation of fire effects monitoring, with FMO and PFS.
- Participates, as requested, in prescribed burning and wildland fire suppression.

Zone Fire Management Officer (FMO)

- Responsible for all fire related planning and implementation for the Refuge.
- Integrates biological Refuge objectives into all fire management planning and implementation.
- Solicits program input from the RM and Biologist.
- Supervises prescribed fire planning.
- Coordinates fire related training.
- Coordinates with cooperators to ensure adequate resources are available for fire operational needs.
- Is responsible for implementation of this Plan. This responsibility includes coordination and supervision of all prevention, pre-suppression, detection, wildland fire, prescribed fire, suppression, monitoring, and post-fire activities involving Refuge lands.
- Is responsible for preparation of fire reports following the suppression of wildland fires and for operations undertaken while conducting prescribed fires.
- Submits budget requests and monitors FIREBASE funds.
- Maintains records for all personnel involved in suppression and prescribed fire activities, detailing the individual's qualifications and certifications for such activities.
- Updates all fire qualifications for entry into the Fire Management Information System.
- Nominates personnel to receive fire-related training, as appropriate.
- Designates the person to serve as Incident Commander (IC) for initial attack purposes. The FMO may assume the position of IC at his/her discretion or designate other personnel to take over that position at his/her discretion.

Prescribed Fire Specialist (PFS)

- Responsible for the planning and implementation of a program, which collects information for the documentation, analysis, and prediction of fire behavior and effects.
- Develops and recommends, plans, and schedules management ignited fire activities for the Refuge.
- Implements and directs burns.
- Plans and develops a program to collect information on the effects and behavior of prescribed fire.
- Plans and directs studies to monitor and analyze fire behavior parameters, then uses these data to support the development of fire plans.
- Plans and directs surveys for the collection, analysis and documentation of data relating to fire effects on biotic and abiotic resources.
- Organizes and performs studies to develop fire management prescriptions for prescribed burns.
- Is responsible for ensuring a cadre of qualified prescribed fire overhead by recommending personnel for training, through both formal in-house and field training assignments.
- Is responsible for record keeping associated with burn planning, fire occurrence reporting and fire weather.
- Identifies areas of fire management requiring research and works with research scientists in the development of project statements to accomplish this research.

Fire Management/Suppression Personnel

- Consist of all Refuge personnel, whether permanent or seasonal, who meet the minimum standard set by the National Wildfire Coordinating Group (NWCG) for firefighters.
- Are fully equipped with proper personal protective equipment, have taken and passed the minimum classroom training, and meet physical fitness standards required.
- Undertake fire management duties as assigned by the Prescribed Fire Burn Boss on each prescribed fire project.
- Are responsible for their personal protective equipment and physical conditioning, qualifying annually with the work capacity test before May 31.

Incident Commander

Incident Commanders (of any level) use strategies and tactics as directed by the Refuge Manager and Wildland Fire Situation Assessment (WFSA) where applicable to implement selected objectives on a particular incident. A specific Limited Delegation of Authority (Appendix G) will be provided to each Incident Commander prior to assuming responsibility for an incident. Major duties of the Incident Commander are given in NWCG Fireline Handbook, including:

- Brief subordinates, direct their actions and provide work tools
- Ensure that safety standards identified in the Fire Orders, the Watch Out Situations, and agency policies are followed at all times.
- Personally scout and communicate with others to be knowledgeable of fire conditions, fire weather, tactical progress, safety concerns and hazards, condition of personnel, and needs for additional resources.
- Decides when to request overhead or additional firefighting personnel and equipment.
- Order resources to implement the management objectives for the fire.

- Inform appropriate dispatch of current situation and expected needs.
- Coordinate mobilization and demobilization with dispatch and the FMO.
- Perform administrative duties; i.e., approving work hours, completing fire reports for command period, maintaining property accountability, providing or obtaining medical treatment, and evaluating performance of subordinates.
- Assure aviation safety is maintained to the highest standards.

Initial Attack Teams

Initial attack teams will consist of experienced, fully- qualified firefighters, those on their first fire, and well-qualified leadership. Teams will be prepared and equipped with hand and power tools as needed and will be dispatched with a day's supply of food and water, so they can continue work for 24 hours without additional support.

Employees participating in any wildland fire activities on Fish and Wildlife Service or cooperator's lands will meet fitness and training requirements established in PMS 310-1, except where Service-specific fitness requirements apply.

INTERAGENCY OPERATIONS

There are no formal cooperative fire agreements in place at this time, however a Memorandum of Understanding is currently being established between the Refuge and the Contra Costa County FPD. The Contra Costa County FPD has traditionally responded to wildland fires at the Refuge because of their legal fire protection responsibility to the property surrounding the Refuge. Thus, any wildland fire originating on Refuge lands is considered a threat to their property.

Antioch Dunes NWR will use the Incident Command System (ICS) as a guide for fireline organization. Qualifications for individuals is per DOI Wildland Fire Qualifications and Certification System, part of NIIMS and the National Wildland Fire Coordination Group (NWCG) Prescribed Fire Qualification Guide. Depending on fire complexity, some positions may be filled by the same person.

A listing of key interagency contacts can be found in the Fire Dispatch Plan. The plan is an annual assembly of information required to facilitate a rapid response to a fire report and to coordinate the initial attack (Appendix F).

PROTECTION OF SENSITIVE RESOURCES

Aggressive attack of all unplanned ignitions with minimum acreage burned is the goal. Heavy equipment shall not be used due to the sensitivity of the habitat, except in cases where life or fire-fighter safety is threatened or when the Refuge Manager determines necessary. Suppression guidelines will be discussed with Contra Costa County FPD during annual operating plan meetings.

The Regional Archaeologist and/or his/her staff will work with fire staff, project leaders, and incident commanders to ensure that cultural resources are protected from fire and fire management activities. The "Request For Cultural Resource Compliance" form (RCRC, Appendix I) will be used to inform the Regional Archaeologist of impending activities, thereby meeting the regulations and directions governing the protection of cultural resources as outlined in Departmental Manual Part 519, National Historic Preservation Act (NHPA) of 1966, Code of Federal Regulations (36CFR800), the Archaeological Resources Protection Act of 1979, as amended, and the Archaeological and Historic Preservation Act of

1974. The NHPA Section 106 clearance will be followed for any fire management activity that may affect historic properties (cultural resources eligible to the National Register of Historic Places).

Impacts to archaeological resources by fire resources vary. The four basic sources of damage are (1) fire intensity, (2) duration of heat, (3) heat penetration into soil, and (4) suppression actions. Of the four, the most significant threat is from equipment during line construction for prescribed fires or wildfire holding actions (Anderson 1983).

The following actions will be taken to protect archaeological and cultural resources:

Wildland Fires

- Minimum impact fire suppression tactics will be used to the fullest extent possible.
- Resource Advisors will inform Fire Suppression personnel of any areas with cultural resources. The Resource advisor should contact the Regional Archaeologist and/or his/her staff for more detailed information.
- Foam use will be limited in areas known to harbor surface artifacts.
- Mechanized equipment should not be used in areas of known cultural significance.
- The location of any sites discovered as the result of fire management activities will be reported to the Regional Archaeologist.
- Rehabilitation plans will address cultural resources impacts and will be submitted to the Regional Archaeologist using the RCRC.

Prescribed Fires

- The Refuge Fire staff will submit a completed RCRC to the Regional Archaeologist and/or his/her staff as soon as the burn area is identified (i.e., as soon as feasible).
- Upon receipt of the RCRC, the Regional Archaeologist and/or his/her staff will be responsible for consulting with the FMO and evaluating the potential for adverse impacts to cultural resources.
- When necessary, the Regional Archaeologist and/or his/her staff will coordinate with the State Historic Preservation Officer (SHPO). The SHPO has 30 days to respond. The Refuge will consider all SHPO recommendations.
- Mechanized equipment should not be used in areas of know cultural significance.
- The location of any sites discovered as the result of fire management activities will be reported to the Regional Archaeologist.

WILDLAND FIRE ACTIVITIES

Fire program management describes the operational procedures necessary to implement fire management at Antioch Dunes NWR. Program management includes: fire prevention, preparedness, emergency preparedness, fire behavior predictions, step-up staffing plan, fire detection, fire suppression, minimum impact suppression, minimum impact rehabilitation, and documentation.

All fires not classified as prescribed fires are wildland fires and will be appropriately suppressed. Suppression operations will generally be conducted by Contra Costa County Fire Protection District (CCFD).

Records show that fire season is typically from May-October. Depending on the specific weather of any particular year the seasons may be shorter or longer and, therefore, may start earlier or last longer.

FIRE MANAGEMENT STRATEGIES

All unplanned wildland fires will be suppressed in a prompt, safe, aggressive, and cost-effective manner to produce fast, efficient action with minimum damage to resources using appropriate management strategies.

Fire suppression strategies at Antioch Dunes NWR will include a range of suppression techniques in order to provide for protection of values at risk, natural resources, firefighter safety and cost efficiency. Suppression strategies and tactics will be unique to each wildland fire, predicated by weather parameters, fuel conditions, safety considerations, resources, and threats to the endangered, threatened and sensitive species. Determination of strategies and tactics will be made by the Incident Commander on scene utilizing knowledge of Refuge fire management objectives and input from Refuge Manager or designate.

All wildland fires will be suppressed. However, there may be occasions when direct attack in high intensity, rapidly spreading wildland fire would jeopardize firefighter safety and may not be appropriate. In these cases indirect strategy will be employed utilizing natural and man-made firebreaks as wildland fire control points.

The following will be employed to meet fire management objectives:

1) Suppress all unplanned ignitions in a safe and cost effective manner consistent with resources and values at risk. Minimum impact strategies and tactics will be used, particularly in areas with high densities of endangered species.

2) Conduct all fire management programs in a manner consistent with applicable laws, policies and regulations.

3) Initiate cost effective fire monitoring which will inform managers if objectives are being met. Monitoring information will also be used to refine burn prescriptions to better achieve objectives.

4) Utilize prescribed fire as a management tool for achieving hazard fuel reductions and resource management objectives. To the extent possible, hazard fuel prescribed fire will be used to accomplish specific restoration objectives established for individual land units. Prescribed fires

are fires which are deliberately set to burn under prescribed conditions in order to achieve pre-determined resource management objectives.

Although resource impacts of suppression alternatives must always be considered in selecting a fire management strategy, resource benefits will not be the primary consideration. Appropriate suppression action will be taken to ensure firefighter safety, public safety, and protection of resources.

Critical protection areas, such as adjacent properties and sensitive habitat will receive priority consideration in fire control planning efforts. In all cases, the primary concerns of fire suppression personnel shall be safety, and if needed, all individuals not involved in the suppression effort may be evacuated.

Suppression strategies should be applied so that the equipment and tools used to meet the desired objectives are those that inflict the least impacts upon the natural and cultural resources. Minimum impact suppression tactics will be employed to protect all resources. Natural and artificial barriers will be used as much as possible for containment. When necessary, fire line construction will be conducted in such a way as to minimize long-term impacts to resources.

Heavy equipment such as crawlers, tractors, dozers, or graders will not be used within the refuge boundaries unless their use is necessary to prevent a fire from destroying privately-owned and/or government buildings and historic resources. The use of any heavy equipment requires approval from the Refuge Manager or designate.

Sites impacted by fire suppression activities or by the fire will be rehabilitated as necessary, based on an approved course of action for each incident.

PREPAREDNESS

Preparedness is the work accomplished prior to fire occurrence to ensure that the appropriate response, as directed by the Fire Management Plan, can be carried out. Preparedness activities include: budget planning, equipment acquisition, equipment maintenance, dispatch (Initial attack, extended, and expanded), equipment inventory, personnel qualifications, and training. The preparedness objective is to have a well trained and equipped fire management organization to manage all fire situations within the Refuge. Preparedness efforts are to be accomplished in the time frames outside the normal fire season dates.

The Fish and Wildlife Service has minimum training requirements for all fire positions. The Service is a member to the National Wildfire Coordinating Group (NWCG) and accepts its standards for interagency operations. There is required annual refresher training for all personnel that are involved with wildland fire activities. These requirements are found in the Service Fire Management Preparedness and Planning Handbook, Section 1.5; Training, Qualification, and Certification.

Annual fire readiness requires an inventory of existing cache items. The cache should be capable of outfitting six personnel for wildland fire activities and will be inventoried as ready by May 31 of each year. The cache is located at the San Francisco Bay National Wildlife Refuge Complex (San Francisco Bay NWRC) Headquarters in Newark over 90 miles from the Antioch Dunes NWR. There is no fire

equipment stationed on site, therefore reliance on local fire departments for quick initial attack is of greater value.

Local conditions and the status of local fire department resource availability is a major indicator which would affect the level of fire management activities at the Refuge. Regional and National Preparedness Levels do play a role in determining the level of fire management operations at the Refuge, but less than the local conditions. Local fire restrictions imposed within the Antioch city limits are of greater significance due to the strong influence of Contra Costa County FPD.

Historical Weather Analysis
The fire season generally begins with the curing of annual grasses in late May and extends until the first rains in mid-October. East wind conditions in September and October increase the potential for large fires in the local area.

Contra Costa County Fire Department does not have any weather station data that reflects the conditions at the Refuge. The closest RAWS unit is located at Black Diamond Mine (1,600 foot elevation) but has little in common with the weather conditions at the refuge.

Fire Prevention
An active fire prevention program may be conducted in conjunction with other agencies to protect human life and property, and prevent damage to cultural resources or physical facilities.

A program of internal and external education regarding potential fire danger may be implemented. Visitor contacts, bulletin board materials, handouts and interpretive programs may be utilized to increase visitor and neighbor awareness of fire hazards. Employees need to relate to the public the beneficial effects of prescribed fires as opposed to unwanted human-caused fires, with emphasis on information, essential to understanding the potential severity of human-caused wildland fires and how to prevent them.

No formal prevention plan has been developed. However, fire lines are mowed along Wilbur Avenue and non-native vegetation control measures are implemented on an annual basis. Additionally, since most wildland fire on the Refuge has been caused by trespassers, Refuge personnel will take appropriate actions to prevent the entry of unauthorized persons.

Staffing Priority Levels
There is no fire-funded staffing stationed at the Refuge. Fire suppression response is provided by Contra Costa County FPD, therefore Contra Costa County FPD will adjust staffing levels based on current fire danger. The refuge is closed to the public and no Refuge facilities are located within the boundaries. Therefore, high fire danger will not require any additional closures.

Training
Departmental policy requires that all personnel engaged in suppression and prescribed fire duties meet the standards set by the National Wildfire Coordinating Group (NWCG). Antioch Dunes NWR will conform strictly to the requirements of the Wildland and Prescribed Fire Management Qualification and Certification System (PM 310-1) and USFWS guidelines.

Basic wildland fire training refreshers are offered annually for red-carded firefighters and records kept in a centralized database. Additional training is available from surrounding agencies in pump and engine operation, power saws, firefighter safety, fire weather and fire behavior, helicopter safety and prescribed fire objectives and activities. On-the job training is encouraged and will be conducted at the field level. Whenever appropriate, the use of fire qualification task books will be used to document fire experience of trainees. The FMO will coordinate fire training needs with those of other nearby refuges, cooperating agencies, and the RO.

The refuge supports the development of individual Incident Command System (ICS) overhead personnel from among qualified and experienced refuge staff for assignment to overhead teams at the local, regional, and national level.

Fire suppression is an arduous duty. On prescribed fires, personnel may be required to shift from implementation/monitoring activities to suppression. Poor physical condition of crew members can endanger safety and lives during critical situations.

Personnel performing fire management duties will maintain a high level of physical fitness. This requires successful completion of a fitness pack test. Personnel must complete a three mile hike with a 45 pound pack in less than 45 minutes.

Supplies and Equipment

A small, 10-person cache for the Refuge is located at the Complex headquarters in Newark. The cache is maintained by the Complex staff.

Additional equipment and supplies are available through cooperators and the interagency cache system. Requests for additional personnel and equipment are made through the Mendocino NF Dispatch. The contact list can be found in the Dispatch plan (Appendix F).

DETECTION

Most wildland fires are reported by the public to 9-1-1. The 9-1-1 dispatchers contact Contra Costa County FPD for suppression response. The refuge is contacted by Contra Costa County FPD to report all wildland fire activities.

The Fire Management Plan does not discriminate between human-caused and lightning caused fire. All wildland fires will be suppressed. However, detection shall include a determination of fire cause. Moreover, human-caused fires will require an investigation and report by law enforcement personnel. For serious human-caused fires, including those involving loss of life, a qualified arson investigator will be requested.

COMMUNICATIONS

There is no open radio communication frequency for Refuge personnel. Instead, staff utilize a direct connect cellular phone system.

Prescribed fire activities performed by Service personnel utilize the various NIFC Tactical channels as needed. Normally NIFC Tactical channels 2 (168.200 mhz) and 3 (168.600 mhz) are used depending upon the number of frequencies needed during prescribed burns.

CCPFD utilizes a ultra high frequency in the 800 mhz band. There is not a common link between Service personnel and CCPFD at this time.

PRE-ATTACK PLAN

The pre-attack plan is reflected by maps which include: locations of water sources, roads, private property, etc (Figure 2 and 3). Access to the Refuge is extremely limited. The San Joaquin River acts as the north boundary of the Refuge. Any wildland fire that cannot be contained from roads or natural boundaries would probably be allowed to burn to the river since road access to the northern portions of the Refuge is extremely limited. However most wildland fires have been successfully contained by local fire department personnel from Wilbur Road and other roads that are open to the public. Contra Costa County FPD has maps and keys for the Refuge.

FIRE MANAGEMENT UNITS

The Refuge will be managed as two units, Sardis and Stamm. The overall objective for both units is to restore the native dune habitat. Suppression of all unplanned ignitions with minimum acreage loss will be employed over the entire Refuge.

During the fire season (May - October), prevailing winds come off the river from the west or northwest at an average of 10-20 mph (Loredo pers. comm. 2001). Mean daily humidities range from around 48 % in the winter to the mid-teens in the spring and summer. Wind conditions during the fall could bring humidities even lower. Typically, humidity is highest during the early morning hours and lowest during the mid-afternoon hours.

The Antioch area has a modified Mediterranean climate with warm to hot dry summers and moist, mild winters. Rainfall averages 12.53 inches annually, falling mainly during November-April. The average annual temperature is 61.8 degrees F with an average annual maximum temperature of 74 degrees F and an average annual minimum temperature of 47 degrees F. The hottest recorded temperature is 114 degrees F, and the lowest recorded temperature is 14 degrees F.

Sardis Unit

The Sardis Unit consists of 14 acres of varying topography. Fuel types in the South Plateau, a primarily flat area along Wilbur Avenue, consists of annual grassland and oak woodland. The rest of the Unit includes a deep pit located approximately 70 feet below the Plateau. Slopes leading down to the pit on the west, south, and east sides are greater than 50%. The slopes are heavily vegetated with annual grasses. The pit consists primarily of undulating shallow dunes covered with annual grasses and shrubby vegetation. To the north of the pit, a mixture of oak woodland, riparian vegetation, and shrub habitat stretch along the San Joaquin River.

In this unit, fire behavior under drought conditions is expected to range from a creeping/ spreading fire along the river to a fast running fire with 6 to 10 foot flame lengths in open grassland. In the drier riparian areas which are dominated by shrubs such as coyote brush and toyon, fire intensity would be significantly greater. Due to the character of the slope and heavy vegetation on the sides of the pit, erratic behavior should be anticipated in this area. In areas adjacent to the river, fire behavior could be expected to be slow and creeping.

Stamm Unit
The Stamm Unit consists of 41 acres of limited topography. Fuel types on the western half of the property consist of dense shrubby vegetation and grasslands over flat terrain. The eastern half consists primarily of tall shrubby vegetation and grassland covering undulating and rolling dunes. Riparian vegetation along the river includes tules, willows, and low trees.

In this unit, fire behavior is expected to range from smoldering in moist vegetation along the river to running and spotting in the tall brush. Maximum expected flame lengths in the tall brush is 10-12'.

Due to staff limitations, relatively small land management parcels, long response times, valuable resources, and values at risk on neighboring lands, this plan does not recommend wildland fire managed for resource benefit as an option for any of the units. Wildland fires will be suppressed using the appropriate suppression response. Prescribed fires will be used to reduce hazardous fuels and to meet resource management objectives.

Fire Effects to Vegetation
The loss and modification of primrose habitat initially caused a decline in the species, eventually leading to its Federal Listing. Currently, the major threat to the primrose is the invasion of non-native plants such as yellow starthistle, vetch, and Ripgut brome. The burning of yellow-starthistle prior to seed production has been documented to reduce the seed bank. This burning needs to be conducted a minimum of three successive years to prove effective and must be followed up with spot herbicide application. Research into the effectiveness of prescribed burning on yellow starthistle continues at Antioch Dunes NWR.

The use of fire to treat yellow starthistle has caused some declines in ripgut brome. Unfortunately, other non-native weeds such as filaree and vetch may colonize the burn areas quickly. Primrose has responded favorably to fire treatments at Antioch Dunes NWR.

SUPPRESSION TACTICS
Wildland fires will be suppressed in a prompt, safe, aggressive, and cost-effective manner to produce fast, efficient action with minimum damage to resources. Suppression involves a range of possible actions from initial attack to final suppression. All wildland fires will be suppressed.

Personnel and equipment must be efficiently organized to suppress fire effectively and safely. To this end, the FMO assumes the command function on major or multiple fire situations, setting priorities for the use of available resources and establishing a suppression organization.

There will be only one Incident Commander responsible through the FMO to the Project Leader. The Incident Commander will designate all overhead positions on fires requiring extended attack. Reference should be made to a Delegation of Authority (Appendix G).

Figure 2. Sardis Unit

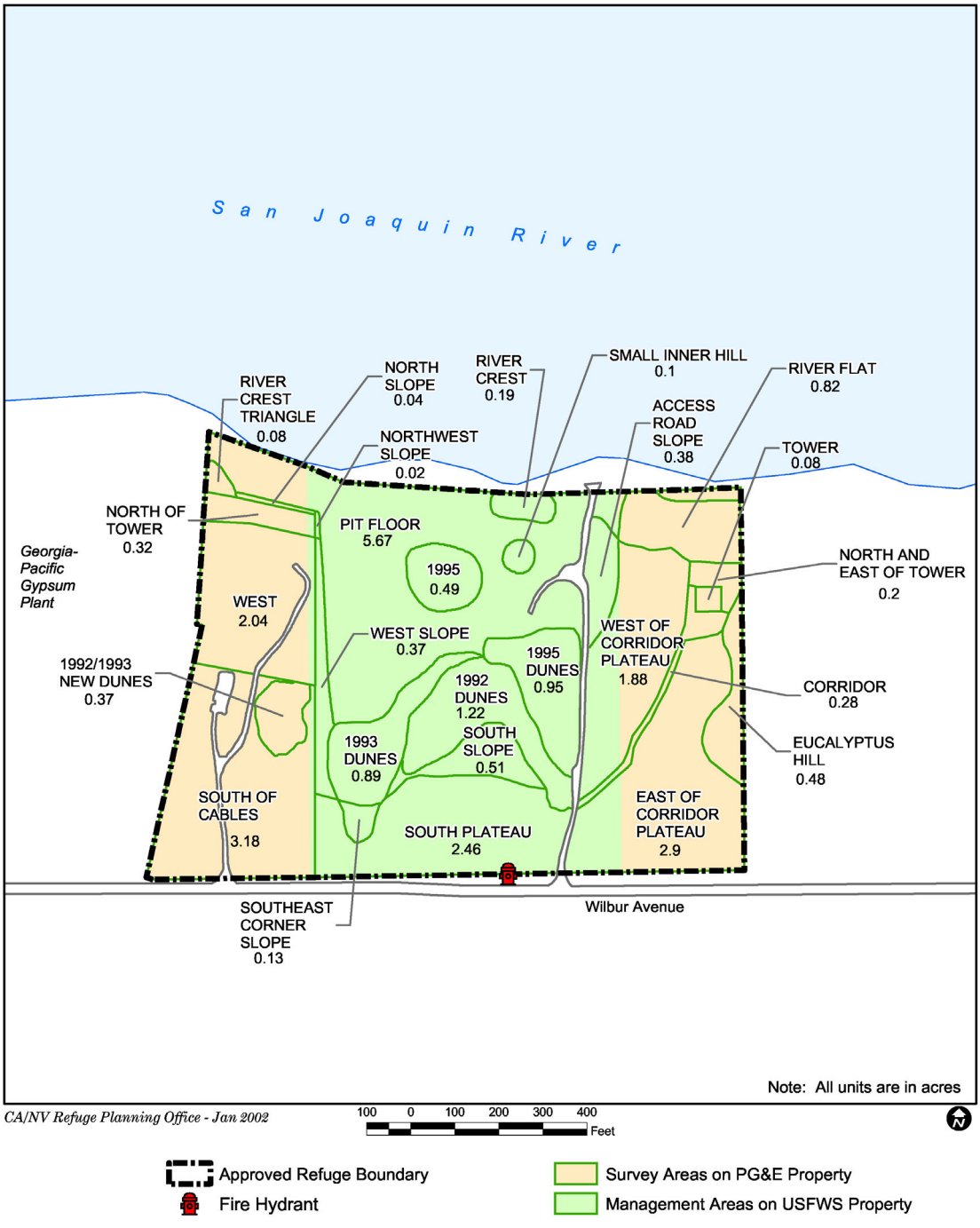
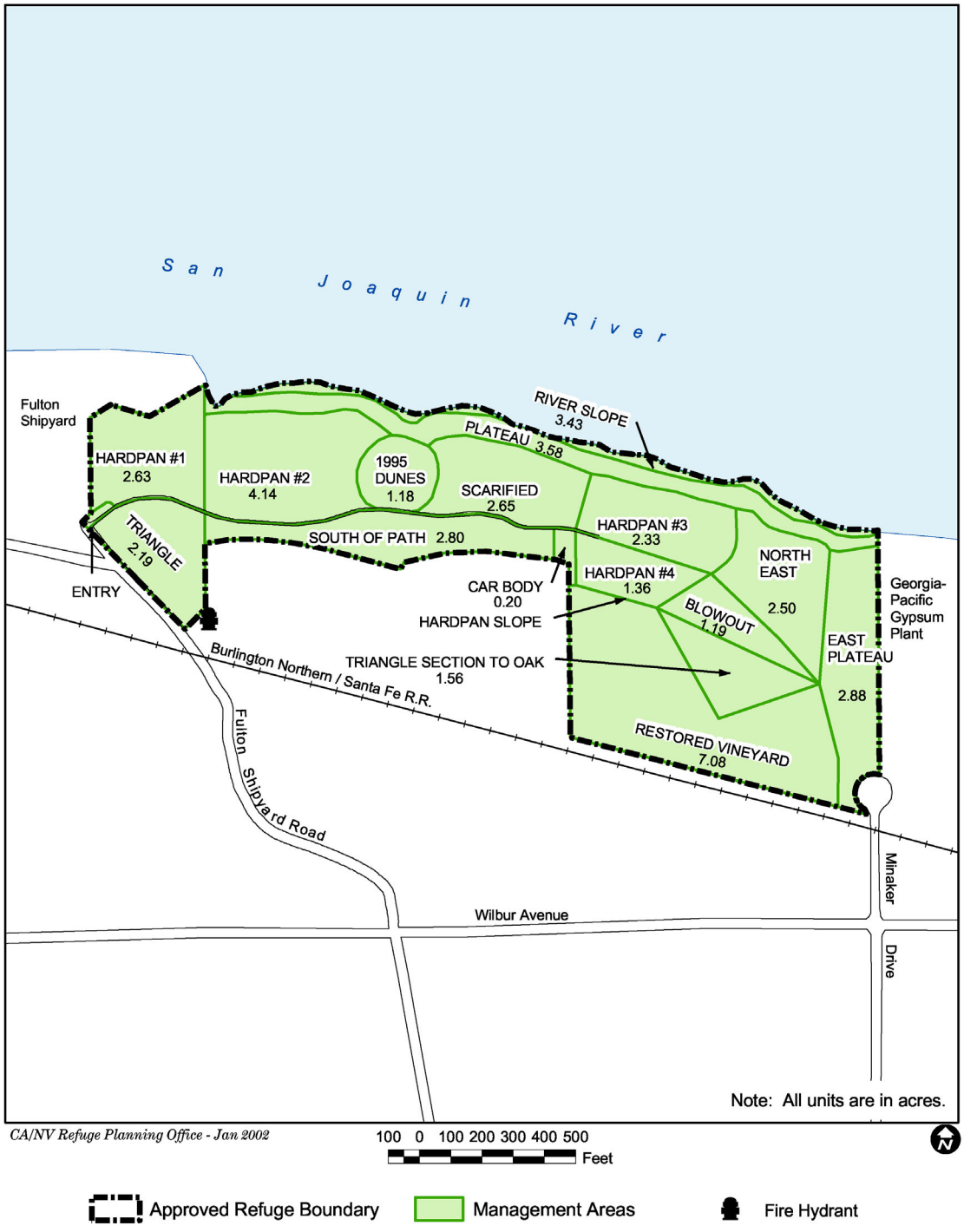


Figure 3. Stamm unit.



Suppression Conditions
The typical fire suppression response to a fire at Antioch Dunes NWR would consist of an IC provided by the Contra Costa County FPD and two engines. Water is the primary method for extinguishing fires. Handline is not usually needed for suppression efforts.

The goal for all unplanned ignitions is to control the fire with minimum acreage burned. Heavy equipment shall not be used due to the sensitivity of the habitat, except in cases where life or fire-fighter safety is threatened or when the Refuge Manager determines necessary. Suppression guidelines will be outlined in a future MOU with Contra Costa County FPD.

Wildland Fire Situation Analysis
For fires that cannot be contained in one burning period, a WFSA must be prepared. In the case of a wildland fire, the Incident Commander, in conjunction with the FMO, will prepare the WFSA. Approval of the WFSA resides with the Refuge Project Leader.

The purpose of the WFSA is to allow for a consideration of alternatives by which a fire may be controlled. Damages from the fire, suppression costs, safety, and the probable character of suppression actions are all important considerations.

Public safety will require coordination between all refuge staff and the IC. Traffic control will be necessary where smoke crosses roads, etc. Where wildland fires cross roads, the burned area adjacent to the road should be mopped up and dangerous snags felled. Every attempt will be made to utilize natural and constructed barriers, including changing fuel complexes, in the control of wildland fire. The first priority for rehabilitation efforts will concentrate on the damages done by suppression activities. A Burned Area Rehabilitation Plan will be prepared for damages caused by the fire itself.

Aircraft Operations
Aircraft may be used in all phases of fire management operations. All aircraft must be Office of Aircraft Services (OAS) or Forest Service approved. An OAS Aviation Policy Department Manual will be provided by OAS.

Helicopters may be used for reconnaissance, bucket drops and transportation of personnel and equipment. Natural helispots and parking lots are readily available in most cases. Clearing for new helispots should be avoided where possible. Improved helispots will be rehabilitated following the fire.

As in all fire management activities, safety is a primary consideration. Qualified aviation personnel will be assigned to all flight operations.

EMERGENCY STABILIZATION AND REHABILITATION
When suppression action is taken, rehabilitation is appropriate. The most effective rehabilitation measure is prevention of impacts through careful planning and the use of minimum impact suppression techniques.

Rehabilitation will be initiated by the Incident Commander, FMO, or Refuge Manager. Rehabilitation will be directed toward minimizing or eliminating the effects of the suppression effort and reducing the potential hazards caused by the fire. These actions may include:

1. Backfill control lines, scarify, and seed.
2. Install water bars and construct drain dips on control lines to prevent erosion.
3. Install check dams to reduce erosion potential in drainages.
4. Restore natural ground contours.
5. Remove all flagging, equipment and litter.
6. Consider and plan more extensive rehabilitation or revegetation to restore sensitive impacted areas.

If revegetation or seeding is necessary, only native plant species will be used.

If Emergency Stabilization and Rehabilitation (ESR) measures are needed or if rehabilitation is needed to reduce the effects of a wildland fire then the Refuge can request appropriate funding through the burned area ESR fund. The ESR fund is administered through the Service's ESR coordinator at the National Interagency Fire Center.

Fire rehabilitation will be as prompt as possible to prevent erosion and spread of non-native plants. This will be developed by the Refuge staff and submitted to the Regional Fire Management Coordinator for review within 90 days of the unplanned ignition being declared out.

REQUIRED REPORTING

A DI-1202, fire report, will be filled out and submitted to the Regional Fire Management Officer for input into the Fire Management Information System (FMIS) within 20 days of the fire being declared out. Copies of reports from the Contra Costa County FPD will be obtained and report will be written to summarize the specifics of the fire, actions taken and outcomes from those actions. A formal review will be conducted on all serious injuries and losses of significant resources.

FIRE INVESTIGATION

Fire management personnel will attempt to locate and protect the probable point of origin and record pertinent information required to determine fire cause. They will be alert for possible evidence, protect the scene and report findings to the fireline supervisor.

The Refuge Manager, FMO, or IC may request a fire investigator through the Contra Costa County FPD. Prompt and efficient investigation of all suspicious fires will be carried out. However, fire management personnel should not question suspects or pursue the fire investigation unless they are currently law enforcement commission qualified.

Personnel and services of other agencies may be utilized to investigate wildland fire arson or fire incidents involving structures. All fire investigations should follow the guidelines outlined in 4.1-2 of the Fire Management Handbook (2000).

PRESCRIBED FIRE ACTIVITIES

PRESCRIBED BURN PROGRAM OBJECTIVES

Prescribed fire can be a useful tool for restoring and maintaining natural conditions and processes at Antioch Dunes NWR.

Specific management needs for the refuge as a whole and for specific areas will be determined annually. Specific burn objectives, fire frequency rotation, firing methodology, and prescriptions will vary from year to year. Burn plans will be updated to reflect any variations. The Project Leader will approve prescribed fire plans.

There are two main objectives for the Antioch Dunes NWR: 1) To protect, enhance, and recover populations of endangered, threatened, and rare species of the Antioch Dunes Ecosystem, and 2) To protect, restore, and enhance the Antioch Dunes ecosystem for a diversity of native plant and insect species.

Historically, many factors have contributed to the decline of the three endemic endangered species: Antioch Dunes evening primrose, Contra Costa wallflower, and Lange's metalmark butterfly. Currently, however, the primary threat to these species is competition with non-native vegetation. The primrose appears to be particularly vulnerable to non-native vegetation encroachment. Despite Refuge management efforts to control non-native species by hand pulling and herbicide treatment, primrose numbers have decreased substantially in recent years. If non-native vegetation is not controlled, extinction of the primrose is highly likely.

While a wildland fire could negatively impact endangered plant populations, a properly timed prescribed fire would reduce competition from non-natives and create more suitable habitat for endangered and native species, which are dependant on relatively open, sand dune habitat. Objectives of prescribed fire in the Antioch Dunes NWR would be to: 1) Eliminate existing non-native plants and their seed heads, 2) Reduce hazardous fuels and organic matter, 3) Reduce the non-native seed bank, 4) stimulate native plant growth and 5) Prepare the area for transplanting endangered plants by exposing sandy soil substrate.

A multi-year prescribed burning program has been implemented encompassing both the Stamm and Sardis Units of the Antioch Dunes NWR. In the initial year, several sites (each approximately 3-5 acres) were burned according to a detailed prescribed burn plan. Sites selected had high densities of non-natives (primarily annual grasses, yellow starthistle, and Russian thistle), and few endangered species. A monitoring program was initiated to measure vegetation response in the burn areas and in non-burned control plots. If the results are favorable, additional areas on the Stamm and Sardis Units will be burned on a rotational basis in subsequent years. Endangered species and other native species would be planted in the burned areas after the non-native seed bank has been reduced.

Small experimental plots (each approximately 7 sq. yards) containing primrose and buckwheat were also burned in order to test the response of these native species to fire. This step is important because it is assumed that fire was not a component of these species' natural ecosystem, so the results on native species is difficult to predict.

All planned ignitions will be accomplished using qualified personnel. This will include annual refresher training as stated in the Service Fire Management Preparedness and Planning Handbook (See section 1.5.1).

Prescribed fires involve the use of fire as a tool to achieve management objectives. Research burning may also be conducted when determined to be necessary for accomplishment of research project objectives. Actions included in the prescribed burn program include: the selection and prioritization of prescribed burns to be carried out during the year, prescribed burn plans, burn prescriptions, burn operations, documentation and reporting, and burn critiques.

Several units of 3-5 acres each will be burned in any one season. Only one burn will be executed at a time. Fuel types are primarily annual grasses, annual forbs, and some perennial brush species (Fire Behavior Fuel Models 1 and 3). There are several smoke sensitive areas in the vicinity: The City of Antioch lies west, south and east of the Antioch Dunes NWR, and smoke could drift over the area. The railroad lies directly south of the Refuge. Due to the small size of the areas proposed for burn, and the fine nature of the fuels, consumption of target fuels would take a short time (about an hour), minimizing the amount of smoke. Public concern about prescribed burning is anticipated to be low because it will be over with quickly and without any lingering smoke. Past prescribed burns conducted at Antioch Dunes NWR have shown that smoke rapidly dissipates if burning occurs during unstable atmospheric conditions.

FIRE MANAGEMENT STRATEGIES

All prescribed fire activity will comply with applicable Federal, state, and local air quality laws and regulations. All prescribed fire projects will have a burn plan approved by the Project Leader. Each burn plan will be prepared using a systematic decision-making process, and contain measurable objectives, predetermined prescriptions, and using an approved environmental compliance document. Appropriate NEPA documentation and Section 7 consultation (Appendix C and D) exist for this Fire Management Plan. Therefore, additional NEPA documentation will be necessary only for prescribed fire projects not meeting the criteria outlined in this Plan.

Prescribed Fire Burn Plans must include components such as a Go/ No-Go Checklist, contingency actions to be taken in the event the prescription is exceeded, and the need for alerting neighbors and appropriate public officials to the timing and the planning of the burn. A burn plan format meeting all required needs is located in Appendix E.

Fire monitoring will be used to evaluate the degree to which burn objectives are accomplished. Monitoring can assist managers in documenting success in achieving overall programmatic objectives and limiting occurrence of undesired effects.

PRESCRIBED FIRE PLANNING

The two existing Refuge units, Stamm (41 acres) and Sardis (14 acres) also serve as discrete Fire Management Units. Within these units, there are currently two Prescribed Burn Areas identified for the Stamm Unit (Hardpan 1 and Vineyard), and one Prescribed Burn Area identified for the Sardis Unit (South Plateau; Figures 1-3). These will likely be expanded or additional units identified in the future.

The prescribed burning season is May-June. During these months, the grasses are dry enough to carry a hot fire that is required to reduce the non-native seed bank and the seed heads. Yellow star-thistle would be approximately 5% flower during this time, which is the optimum time to burn it because the fire would destroy the thistle before it produces seed, yet it will have expended enough energy to prevent regrowth.

This correlates with overall Fire Management Objectives to: 1) Use prescribed fire to accomplish resource management objectives, and 2) Protect endangered species and other native species from a large scale wildland fire, which could potentially wipe out all, or major portions of, available habitat.

Annual Activities

The FMO will be responsible for completing an annual fire summary report. The report will contain the number of fires by type, acres burned by fuel type, cost summary, personnel utilized, and fire effects.

The Refuge Manager, Biologist, and FMO will determine burn unit priorities, timing, and burn plan development schedule by February of each year. Burn Plans will be prepared and submitted for Project Leader review and approval by April. The Burn Plan will be submitted to the Air Quality District by April 30 for smoke management review and authorizing letter.

Prescribed Fire activities will be reviewed annually. Necessary updates or changes to the Fire Management Plan will be accomplished prior to the next fire season. Any additions, deletions, or changes will be reviewed by the Refuge Manager to determine if such alterations warrant a re-approval of the plan.

Prescribed Burn Plan

The Prescribed Burn Boss will conduct a field reconnaissance of the proposed burn location with the FMO, AFMO, PFS, biologist, and/or Refuge Manager to discuss objectives and special concerns, and to gather all necessary information to write the Burn Plan. After completing the reconnaissance, the a qualified Burn Boss will write the Prescribed Burn Plan.

All prescribed fires will have Prescribed Burn Plans. The Prescribed Burn Plan is a site specific action plan describing the purpose, objectives, prescription, and operational procedures needed to prepare and safely conduct the burn. The treatment area, objectives, constraints, and alternatives will be clearly outlined. No burn will be ignited unless all prescriptions of the plan are met. Fires not within those parameters will be suppressed. Prescribed Burn Plans will follow the format contained in Appendix E. Each burn plan will be reviewed by the Refuge Manager, Biologist, FMO/AFMO, PFS, and Burn Boss. The Project Leader has the authority to approve the burn plan. The term “burn unit” refers to a specific tract of land to which a Prescribed Burn Plan applies.

Strategies and Personnel

Execution of prescribed burns will only be executed by qualified personnel. The Prescribed Burn Boss will fill all required positions to conduct the burn with qualified personnel. All personnel listed in the Burn Plan must be available for the duration of the burn or the burn will not be initiated. Personnel will meet minimum USFWS fitness and qualifications standards for prescribed burning.

Weather and fuel moisture conditions must be monitored closely in planned burn units to determine when the prescription criteria are met. A belt weather kit may also be utilized to augment monitoring. Fuel moisture samples of 10-, 100-, and 1000-hour down and dead logs (where applicable) and of live plants may be monitored each week and percent moisture contents figured to help determine when the prescription criteria are met.

When all prescription criteria are within the acceptable range, the Prescribed Burn Boss will select an ignition date based on current and predicted weather forecasts. A thorough briefing will be given by the Prescribed Burn Boss and specific assignments and placement of personnel will be discussed. An updated spot weather forecast will be obtained on the day of ignition and all prescription elements will be rechecked to determine if all elements are still within the approved ranges. If all prescription elements are met, a test fire will be ignited to determine on-site fire behavior conditions as affected by current weather. If conditions are not satisfactory, the test fire will be suppressed and the burn will be rescheduled. If conditions are satisfactory the burn will continue as planned.

Depending upon the complexity of the burn, two or more fire crews (3 crew members per crew) from the Central Valley Refuges Zone and 3-4 collateral fire duty personnel from San Francisco Bay NWRC may be needed to ignite, hold, and mop-up the burn. In addition, personnel and equipment from Contra Costa County FPD shall be available in the event that fire spreads outside Refuge property and into their local area of responsibility. A qualified Prescribed Burn Boss Type II or higher will be required to write the Burn Plan and serve as Burn Boss during any planned ignitions

One person with botanical/sampling design expertise will also be needed to conduct pre and post burn monitoring. One person with biological/botanical expertise will be needed to assist in developing site specific prescribed burn plans.

Only qualified personnel will be used to conduct burns on the Refuge. Pre- and post-fire briefings will be conducted on all planned ignitions.

Coordination needed with the following entities:

- Bay Area Air Quality Management District: Written approval required; Burn Plan needs to be submitted 30 days in advance of planned ignition; day of fire approval required.
- City of Antioch Public Works: Needs to be contacted 1 week prior to proposed burn date.
- City of Antioch Police Department: Needs to be contacted the day of the burn to notify them of potential smoke across roads.
- Contra Costa County FPD: Needs to receive copy of prescribed burn plan 1 month in advance.
- Burlington Northern Railroad: Needs to be contacted 1 week prior to burn to advise them of potential smoke across tracks.
- Pacific Gas and Electric Company; Georgia Pacific Company and other adjacent landowners: Adjacent or nearby landowners need to be contacted 1 week prior to the burn so that vehicles are moved and employees are aware of the burn.

The Refuge will procure burn permits and follow procedures in them. In addition, the Zone Fire Management Officer or an individual qualified at the Prescribed Burn Boss Type II level will write a Burn Plan to be approved by the Project Leader. The guidance and format for writing Burn Plans is

found in the Service's Prescribed Fire Management Handbook, Section 2.2. All ignitions require a DI-1202 form to be completed and returned to the responsible fire management officer for input into the Fire Management Information System (FMIS) within 20 days after the fire is declared out.

If the prescribed burn escapes the predetermined burn area, all further ignition will be halted except as needed for suppression efforts. Suppression efforts will be initiated, as discussed in the preburn briefing. The FMO will be notified immediately of any control actions on a prescribed burn. If the burn exceeds the initial suppression efforts, the burn will be declared a wildland fire and suppressed using guidelines established in this plan. If a prescribed burn is declared a wildland fire, all personnel must meet NWCG qualifications and fitness levels for wildland fire activities. A WFSA will be completed and additional personnel and resources ordered as determined by the Incident Commander. If the fire continues to burn out of control, additional resources will be called from the local cooperating agencies via the servicing dispatch. A management overhead team may be requested to assume command of the fire.

Recommendations of the Bay Area Air Quality Management District will be followed which will satisfy the District's criteria for use of the "72-Hour Outlook/48-Hour Decision" forecasting procedure. These may include restrictions on igniting under certain wind speeds/directions, humidity, or other conditions that would cause local air quality to be degraded. Other conditions under which fires will not be ignited include: east wind conditions, Red Flag Warnings /Watches as determined by Contra Costa County FPD, situations where local fire department resources are over committed to wildland fires in the Bay Area (i.e., Oakland Hills Fire 1991 or Vision -Pt. Reyes Fire 1995). The prescribed fire plan will also identify other "no-go" or suppression criteria. Prior to any planned ignitions, Burn Boss will contact Contra Costa County FPD Emergency Communications Center to determine resource availability in case of an escaped burn.

Monitoring and Evaluation

Monitoring of prescribed fires is intended to provide information for quantifying and predicting fire behavior and its ecological effects on refuge resources while building a historical record. Monitoring measures the parameters common to all fires: fuels, topography, weather and fire behavior. In addition, ecological changes such as species composition and structural changes will be monitored after a fire. This information will be very useful in fine-tuning the prescribed burn program.

All wildland fires will be appropriately suppressed. However, monitoring wildland fires may be appropriate and potentially valuable in mapping and documenting the growth of the fire, measuring on-site weather and fuel loading to provide the fire staff with present and expected fire behavior and effects. During prescribed burns, monitoring can serve as a precursor to invoking suppression action by determining if the fire is in prescription, assessing its overall potential, and determining the effects of the prescribed burn.

During prescribed burning, monitoring should include mapping, weather, site and fuel measurements and direct observation of fire characteristics such as flame length, rate of spread and fire intensity. Operational monitoring provides a check to insure that the fire remains in prescription and serves as a basis for evaluation and comparison of management actions in response to measured, changing fire conditions, and changes such as fuel conditions and species composition.

Fires may be monitored regardless of size. The FMO will establish specific fire information guidelines for each fire to update intelligence about the fire. Highest priority for monitoring will be assigned to large fires or fires which threaten to leave the refuge.

Short term: BEHAVE predictions will be used to model fire behavior, and a belt weather kit will be used to monitor actual burn day conditions.

Long term: The response of native and non-native vegetation to fire will be monitored. Plant species composition and percent cover will be measured pre- and post-burn for certain native and weed species of concern.

Monitoring must be done to document and verify that the stated objectives have been met. Plots, photo points, or other methods will be developed to document the results of the burn. These data will be stored for future refinement of prescriptions and to determine the success of the program.

Required Reports

All prescribed burn forms will be completed as outlined by the Prescribed Burn Boss. A monitor will be assigned to collect all predetermined information and complete all necessary forms prior to, during, and after the burn. All records will be archived in the refuge's fire records for future use and reference.

The Prescribed Burn Boss will prepare a final report on the prescribed burn. Reports will include a calculations of particulate matter emissions and a monitoring report. Information will include a narrative of the burn operation, a determination of whether objectives were met, weather and fire behavior data, map of the burn area, photographs of the burn, number of work hours, and final cost of the burn.

Prescribed Burn Critique

A report detailing the actual burn will accompany any recommendations or changes deemed necessary in the program. This report will be submitted to the Refuge Project Leader. A post-season critique of the fire management program, including the prescribed burn program, will be held each year at the conclusion of the fall fire season.

AIR QUALITY / SMOKE MANAGEMENT GUIDELINES

Air quality is monitored and managed by the Bay Area Air Quality Management District. Although they do not issue Burn Permits, they do grant permission to burn if a burn proposal falls under one of their open burning categories. In order to qualify for one of their open burning categories (Regulation 5), the Refuge needs to determine which category best meets the intent and objective of the project. Previous burns at Antioch Dunes NWR fell under Regulation 5-Open Burning, Section 8 Allowable Fires, Subsection P-Wildland Vegetation Management, 401.16. In addition, Section 5-408 sets forth those requirements needed to conduct prescribed burning. These requirements need to be adhered to in order to receive permission to conduct a prescribed burn.

In order to obtain permission to burn under this category, a Burn Plan must be submitted to the Enforcement Branch at least 30 days prior to burning. BAAQMD grants permission to burn on a case-by-case basis. There is no recurring or annual burn permit/ permission. The Refuge will need to obtain permission for each burn project planned. The Refuge will follow all conditions contained in the letter of permission.

Specific aspects of a Smoke Management Plan (wind, weather, visibility hazard, and residual smoke problems) will be addressed in Prescribed Burn Plans prepared for each burn.

FIRE RESEARCH

The Refuge will continue collecting data and monitoring the success or failure of burning conditions required to accomplish objectives of controlling non-native vegetation and restoring riverine sand dune habitat. Weather conditions will be recorded to establish future successful/ideal burning results. Normal fire program monies are not intended to fund fire research activities.

The Refuge has identified a research need to determine the short-term and long-term effects of prescribed burning on invertebrate abundance and diversity. Data collected will be presented to the refuge as results become available.

PUBLIC SAFETY

Antioch Dunes NWR is dedicated to ensuring the safety of all residents and property adjacent to the refuge's boundary.

Firefighter and pubic safety will always take precedence over property and resource protection during any fire management activity. For public safety, the fire scene will remain clear of unauthorized people. The responsibility for managing public safety lies with the Incident Commander (IC) or Burn Boss for wildland or prescribed fire. Public safety considerations will be included as part of the burn prescription.

Due to the proximity of Wilbur Road to the Refuge, Burn Boss and Refuge Manager will coordinate traffic control along Wilbur Road with Refuge Law Enforcement Officers and local law enforcement when burns are conducted.

Due to the proximity of the Burlington Northern Santa Fe Railroad to the Refuge, Burn Boss and Refuge Manager will notify Railroad Security Officers of planned burns.

See Appendix H for list of adjacent landowners with phone numbers and addresses for notification purposes.

During prescribed burns at least one burn team member will have first aid training. A first aid kit will be on-site for prescribed burns as well as wildland fires. The local police, fire, and emergency medical services will be notified prior to the ignition of any prescribed burn. They will also be notified of the location of any wildland fires.

PUBLIC INFORMATION AND EDUCATION

Educating the public on the value of fire as a natural process is important to increasing public understanding and support for the fire management program. The refuge will use the most appropriate and effective means to explain the overall fire and smoke management program. This may include supplemental handouts, signing, personal contacts, interpretive signs, or media releases. When deemed necessary, interpretive presentations will address the fire management program and explain the role of fire in the environment.

Informing the public is an important part of the fire management program. During a wildland fire, the IC is responsible for providing information to the public. Prescribed fire public information has been further addressed in the Prescribed Fire Plan and the Environmental Assessment (See Appendices C and D).

The public information program will be developed as follows:

1. Concepts of the prescribed burn program will be incorporated, as appropriate, in publications, brochures, and handouts.
2. The fire management program may be incorporated into visitor contacts. Particular attention will be given when fires are conspicuous from roads or visitor use areas.
3. News releases will be distributed to the media as appropriate.
4. The public information outlets of neighboring and cooperating agencies and the regional office will be provided with all fire management information.
5. The fire management program will be discussed in informal talks with all employees, volunteers, residents, and neighbors.

Prior to the lighting of any planned ignition, information will be made available to visitors, local residents, and/or the press about what is scheduled to happen and why. This information will include prescribed burn objectives and control techniques, fire location and expected behavior, effects caused by the fire, and potential impacts on private and public facilities and services.

FIRE CRITIQUES AND ANNUAL PLAN REVIEW

FIRE CRITIQUES

Fire reviews will be documented and filed with the final fire report. The FMO will provide a copy for the refuge files.

ANNUAL FIRE SUMMARY REPORT

The FMO will be responsible for completing an annual fire summary report. The report will contain the number of fires by type, acres burned by fuel type, cost summary (prescribed burns and wildland fires), personnel utilized, and fire effects.

ANNUAL FIRE MANAGEMENT PLAN REVIEW

The Fire Management Plan will be reviewed annually. Necessary updates or changes will be accomplished prior to the next fire season. Any additions, deletions, or changes will be reviewed by the Refuge Manager to determine if such alterations warrant a re-approval of the plan.

The fire management plan will be updated as major policy decisions are made. At a minimum, this plan will be reviewed once a year by the individual on the Refuge with fire responsibility to maintain the integrity of the plan. Amendments to the fire management plan itself will be made as needed by sending them to the Regional Fire Management Coordinator for concurrence and to be approved by the Regional Director in Portland. Minor changes to the appendices, such as phone number corrections and personnel changes, can be made at the Refuge level and attached to the plan during this yearly review process without involvement of the Regional Office.

CONSULTATION AND COORDINATION

The following agencies, organizations and/or individuals were consulted in preparing this plan.

Chris Bandy, Refuge Manager, Antioch Dunes NWR, Newark, CA

Roddy Baumann, Prescribed Fire Specialist, Pacific Region, USFWS, Portland, OR.

Rachel Hurt, Biologist, San Francisco Bay NWRC, USFWS, Fremont, CA.

Richard Hadley, Assistant Refuge Supervisor, California/ Nevada Operations, USFWS, Sacramento, CA.

Ivette Loredo, Refuge Biologist, Antioch Dunes NWR, USFWS, Fremont, CA

Amanda McAdams, Fire Planner, Pacific Region, USFWS, Portland, OR.

Tom Romanello, Assistant Fire Management Officer, Sheldon-Hart NWR, Lakeview, CA.

APPENDICES

APPENDIX A: REFERENCES CITED

Bailey, R.G. 1995. Description of the ecoregions of the United States. USDA Forest Service. 108 pp.

Green, J.A. 1995. Three reproductive ecology studies in the narrow endemic *Oenothera deltoides* ssp. *howellii* (Onagraceae). M.A. Thesis, Claremont Graduate School.

Loredo, Ivette. USFWS, Personal Communication, 7/2001.

APPENDIX B: DEFINITIONS

Agency Administrator. The appropriate level manager having organizational responsibility for management of an administrative unit. May include Director, State Director, District Manager or Field Manager (BLM); Director, Regional Director, Complex Manager or Project Leader (FWS); Director, Regional Director, Park Superintendent, or Unit Manager (NPS), or Director, Office of Trust Responsibility, Area Director, or Superintendent (BIA).

Appropriate Management Action. Specific actions taken to implement a management strategy.

Appropriate Management Response. Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Appropriate Management Strategy. A plan or direction selected by an agency administrator which guide wildland fire management actions intended to meet protection and fire use objectives.

Appropriate Suppression. Selecting and implementing a prudent suppression option to avoid unacceptable impacts and provide for cost-effective action.

Bureau. Bureaus, offices or services of the Department.

Class of Fire (as to size of wildland fires):
Class A - 3 acre or less.
Class B - more than 3 but less than 10 acres.
Class C - 10 acres to 100 acres.
Class D - 100 to 300 acres.
Class E - 300 to 1,000 acres.
Class F - 1,000 to 5,000 acres.
Class G - 5,000 acres or more.

Emergency Fire Rehabilitation/Burned Area Emergency Rehabilitation (EFR/BAER). Emergency actions taken during or after wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire. The scope of EFR/BAER projects are unplanned and unpredictable requiring funding on short notice.

Energy Release Component (ERC) A number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. It is generated by the National Fire Danger Rating System, a computer model of fire weather and its effect on fuels. The ERC incorporates thousand hour dead fuel moistures and live fuel moistures; day to day variations are caused by changes in the moisture content of the various fuel classes. The ERC is derived from predictions of (1) the rate of heat release per unit area during flaming combustion and (2) the duration of flaming.

Extended attack. A fire on which initial attack forces are reinforced by additional forces.

Fire Suppression Activity Damage. The damage to lands, resources and facilities directly attributable to the fire suppression effort or activities, including: dozer lines, camps and staging areas, facilities (fences, buildings, bridges, etc.), handlines, and roads.

Fire effects. Any consequences to the vegetation or the environment resulting from fire, whether neutral, detrimental, or beneficial.

Fire intensity. The amount of heat produced by a fire. Usually compared by reference to the length of the flames.

Fire management. All activities related to the prudent management of people and equipment to prevent or suppress wildland fire and to use fire under prescribed conditions to achieve land and resource management objectives.

Fire Management Plan. A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational procedures such as preparedness plans, preplanned dispatch plans, prescribed fire plans and prevention plans.

Fire prescription. A written direction for the use of fire to treat a specific piece of land, including limits and conditions of temperature, humidity, wind direction and speed, fuel moisture, soil moisture, etc., under which a fire will be allowed to burn, generally expressed as acceptable range of the various fire-related indices, and the limit of the area to be burned.

Fuels. Materials that are burned in a fire; primarily grass, surface litter, duff, logs, stumps, brush, foliage, and live trees.

Fuel loadings. Amount of burnable fuel on a site, usually given as tons/acre.

Hazard fuels. Those vegetative fuels which, when ignited, threaten public safety, structures and facilities, cultural resources, natural resources, natural processes, or to permit the spread of wildland fires across administrative boundaries except as authorized by agreement.

Initial Attack. An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Maintenance burn. A fire set by agency personnel to remove debris; i.e., leaves from drainage ditches or cuttings from tree pruning. Such a fire does not have a resource management objective.

Natural fire. A fire of natural origin, caused by lightning or volcanic activity.

NFDRS Fuel Model. One of 20 mathematical models used by the National Fire Danger Rating System to predict fire danger. The models were developed by the US Forest Service and are general in nature rather than site specific.

NFFL Fuel Model. One of 13 mathematical models used to predict fire behavior within the conditions of their validity. The models were developed by US Forest Service personnel at the Northern Forest Fire Laboratory, Missoula, Montana.

Prescription. Measurable criteria which guide selection of appropriate management response and actions. Prescription criteria may include safety, public health, environmental, geographic, administrative, social, or legal considerations.

Prescribed Fire. A fire ignited by agency personnel in accord with an approved plan and under prescribed conditions, designed to achieve measurable resource management objectives. Such a fire is designed to produce the intensities and rates of spread needed to achieve one or more planned benefits to natural resources as defined in objectives. Its purpose is to employ fire scientifically to maximize net benefits at minimum impact and acceptable cost. A written, approved prescribed fire plan must exist and NEPA requirements must be met prior to ignition. NEPA requirements can be met at the land use or fire management planning level.

Preparedness. Actions taken seasonally in preparation to suppress wildland fires, consisting of hiring and training personnel, making ready vehicles, equipment, and facilities, acquiring supplies, and updating agreements and contracts.

Prevention Activities directed at reducing the number or the intensity of fires that occur, primarily by reducing the risk of human-caused fires.

Rehabilitation (1) Actions to limit the adverse effects of suppression on soils, watershed, or other values, or (2) actions to mitigate adverse effects of a wildland fire on the vegetation-soil complex, watershed, and other damages.

Suppression. A management action intended to protect identified values from a fire, extinguish a fire, or alter a fire's direction of spread.

Unplanned ignition. A natural fire that is permitted to burn under specific conditions, in certain locations, to achieve defined resource objectives.

Wildfire. An unwanted wildland fire.

Wildland Fire. Any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Situation Analysis (WFSA). A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economical, political, and resource management objectives as selection criteria.

Wildland/urban interface fire A wildland fire that threatens or involves structures.

Appendix C: NEPA and NHPA Compliance

FINAL ENVIRONMENTAL ASSESSMENT

Prescribed Burn Program

Antioch Dunes National Wildlife Refuge

San Francisco Bay National Wildlife Refuge Complex

Under the authority of the National Wildlife Refuge System Administration Act of 1966 and Endangered Species Act of 1973

Contra Costa County, California

Prepared by: Erin C. Fernández
Title: Wildlife Biologist
Duty Station: San Francisco Bay National Wildlife Refuge Complex
June 1997

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ABSTRACT

This environmental assessment evaluates alternatives for managing non-native vegetation on the 55-acre Antioch Dunes National Wildlife Refuge (Refuge). The preferred alternative would utilize prescribed burning as a management tool to eliminate non-native vegetation from the Refuge. This unique Refuge was established in 1980 in order to protect three endemic endangered species: the Antioch Dunes evening primrose, Contra Costa wallflower, and the Lange's metalmark butterfly. Historically, many factors have contributed to the decline of these species, including human development and sand mining of the dunes. Currently, however, the primary threat to these species is competition with non-native vegetation. The preferred alternative will drastically reduce the amount of non-native vegetation present at the dunes. Prescribed burning will assist in restoration of the Refuge and enhance habitat for endangered and other native species. No significant adverse socioeconomic impacts to the area are anticipated.

Section I: PURPOSE AND NEED FOR ACTION

The 55-acre Antioch Dunes National Wildlife Refuge (Refuge) and adjacent 12-acre Pacific Gas and Electric (PG&E) land support the last remaining populations of three endangered species including the Antioch Dunes evening primrose (Oenothera deltoides ssp. howellii), Contra Costa wallflower (Erysimum capitatum ssp. angustatum), and the Lange's metalmark butterfly (Apodemia mormo ssp. langei). The primary objective of the Refuge is to provide habitat for these three endemic endangered species. Historically, many factors have contributed to the decline of these species, including human development and sand mining of the dunes. Currently the primary threat to these species is the encroachment of non-native vegetation such as rip-gut brome grass (Bromus diandrus) and yellow starthistle (Centaurea solstitialis).

United States Fish and Wildlife Service (Service) staff actively manages these endangered species by conducting annual population surveys and through habitat restoration. Management tools include the Non-native Vegetation Management Program, which currently includes hand pulling and herbicide treatment of non-natives. Despite our management efforts however, numbers of primrose continue to decline primarily due to competition with weed species.

Primrose numbers have decreased substantially in recent years. There were 5,800 mature primrose in 1984, and only 963 mature primrose in 1996, a decrease of 83%. Primrose appears particularly vulnerable to non-native vegetation encroachment. Green (1995) in her thesis, *Three Reproductive Ecology Studies in the Narrow Endemic Oenothera deltoides ssp. howellii*, found no primrose seedlings around mature primrose that were surrounded by weed species, yet seedlings were found around 40% of mature primrose that were not surrounded by weed species. If non-native vegetation is not controlled, extinction of natural populations of primrose is highly likely.

In order to restore the primrose, the Service must improve and expand our current non-native vegetation management techniques. Ecologists, including Joseph DiTomaso (University of California, Davis), John Rusmore (UC Davis), John Randall (UC Davis), Bruce Pavlik (Mills College) and Martha Hastings (California Department of Parks and Recreation), have advised the Service that prescribed burning will create more suitable habitat for endangered species dependant on the historic sand-dune environment. Prescribed burning of selected areas will control non-native vegetation which will serve to stabilize and increase populations of the primrose and other endangered native species.

Section II: ALTERNATIVES INCLUDING THE PROPOSED ACTION

A. No Action Alternative

This alternative would maintain the status quo of continued hand pulling of weeds and selective herbicide use only. Currently, volunteers and Refuge staff annually pull non-native vegetation approximately once every two weeks in the spring and summer. Refuge staff spray weeds with herbicide once a year in the spring to create a small buffer zone between high desities of endangered species and non-native species.

B. Prescribed Burning Alternative (Proposed action)

This alternative would allow prescribed burning to be used as a tool for endangered species management. Selected dune sites of manageable size would be burned under predetermined conditions, every year or every other year, in order to remove non-native vegetation until the non-native seed bank is exhausted. Burning would then be conducted on an as-needed basis. This will enhance existing habitat and create more suitable habitat for endangered and native species, which are dependant on relatively open, sand-dune habitat.

The first year the Service proposes to burn three, approximately three acre sites on the Refuge that are dominated by non-native vegetation, have very few natives, and a few endangered species. We will establish non-burned control plots similar in vegetative composition to the burn areas. We will monitor both control and non-control areas for species richness and percent cover before and after the burn. We will analyze before and after burn data, as well as compare control areas to burned areas in order to determine the response of non-native vegetation to fire. We will plant native and endangered species in these areas after the non-native seed bank has been substantially diminished, which may take up to three years of burning. If this method proves successful, additional areas will be burned on a rotational basis and subsequently replanted with native and endangered species.

We also propose to burn 15 experimental plots (7 sq. y.) with primrose and buckwheat in order to test the response of primrose and buckwheat to fire. This will be done through the use of a burn box in which we can contain a small fire hot enough to scorch the existing vegetation. Ten of the plots will have one to two primrose, a few natives and many non-natives. Five of the plots will contain buckwheat in order to test the response of buckwheat to fire. We will establish 15 non-burned control plots similar in vegetative composition to the burn areas and monitor these areas for species richness and percent cover before and after the burn. We will analyze before and after burn data, as well as compare control areas to burned areas in order to determine the response of non-native and native vegetation to fire.

The Refuge will monitor prescribed burn plots by recording environmental factors and locating sites with a Global Positioning System. We will monitor areas for native and non-native species richness and percent cover before and after the burn in order to compare control areas to burned areas, as well as to track annual progress of the sites. We will use a combination of line transects and fixed plots to monitor vegetation. We will monitor vegetation both in the middle of these burn plots as well as toward the edge of the burn plot so that we may be able to detect differences in the amount of non-native vegetation resprouting from the residual seed source versus the amount of non-native vegetation encroaching on the burn area from peripheral areas.

Burning would primarily be conducted in May or June in order to achieve two objectives: 1) kill the existing non-native plants and their seed heads; and 2) exhaust the non-native seed bank. In May/June, the grasses will be dry enough to carry a hot fire that is required to destroy the non-native seed bed and the seed heads. The yellow-star thistle should be under 5% flower at this time. This is the optimum time to burn it because the fire would destroy the thistle before it produces seed, yet it will have expended enough energy that it should not regrow in that season. Burning may take place at a less optimum time depending on allowable burn days, however, any burn from spring through fall will help to reduce the non-native seed bank.

C. Increased Weeding Effort Alternative

This alternative would allow only for increased manual removal of exotic vegetation and would preclude prescribed burning as a tool in any management. Work crews would manually pull non-native vegetation every year in order to create suitable habitat for endangered species. The Refuge would require additional full time staff in order to reduce non-native vegetation through manual methods. Vegetation would be monitored using methods similar to that described in Alternative B.

D. Grazing Alternative

This alternative would allow grazing, in addition to ongoing weed control measures, and would preclude prescribed burning as a tool in any management. Livestock would graze selected areas on a rotational schedule to remove non-native vegetation. Vegetation would be monitored using methods similar to that described in Alternative B.

E. Heavy Equipment Alternative

This alternative would allow for the use of mowing, disking, and plowing at the Refuge to control non-native vegetation and would preclude prescribed burning as a tool in any management. Selected areas of the Refuge would be mowed, disked, and/or plowed to remove non-native vegetation. Vegetation would be monitored using methods similar to that described in Alternative B.

Section III: AFFECTED ENVIRONMENT

A. Background information

The Refuge is located along the southern shore of the lower San Joaquin river near the city of Antioch, Contra Costa County, California (Fig. 1). The Refuge lies within an ecoregion described by Bailey (1995) as the Mediterranean Division, California Dry Steppe Province. Historically, the Antioch Dunes extended over two miles along the southern bank of the San Joaquin river and reached heights of 117 feet. The 55-acre Refuge was extensively mined for sand in the past and subsequently ranges in elevation from 0 to 50 feet. The Refuge currently exists as an isolated habitat, surrounded by industrial development.

B. Climate

The Antioch area has a modified Mediterranean climate with warm to hot dry summers and moist, mild winters. Rainfall averages 12.53 inches annually, falling mainly during November-April. The average annual temperature is 61.8 degrees F with an average annual maximum temperature of 74 degrees F and an average annual minimum temperature of 47 degrees F. The hottest recorded temperature is 114 degrees F, and the lowest recorded temperature is 14 degrees F. Winds in the summer come off the river from the west or northwest at an average of 10-20 mph.

C. Soils

Soils in the Refuge are representative of the Oakley sands interlaced with alluvial fan deposits. The Sardis unit (14 acre eastern parcel) was mined down to a clay/peat substrate for the most part and subsequently sand was replaced over many of these areas. The perimeter still consists of sandy loam substrate. The Stamm unit (41 acre western parcel) has a "hard pan" layer of varying thickness but underneath this hard pan is sandy loam. Sand was replaced over a small portion of the mined area of the Stamm unit as well.

D. Vegetation/Wildlife

Six main habitat types are found within the 55-acre Refuge: littoral, riparian, open sand dunes, abandoned vineyard, disturbed/mined areas and grassland areas. The littoral zone contains a state listed rare plant: Mason's lilaeopsis (Lilaeopsis masonii). The riparian area is characterized by native species such as, but not limited to, coast live oak (Quercus agrifolia), red willow (Salix laevigata), narrow-leaved willow (Salix exigua), arroyo willow (Salix lasiolepis), California toyon (Heteromeles arbutifolia) and elderberry (Sambucus mexicana). The open dune areas consist of primarily native species including: Antioch dunes evening primrose, Contra Costa wallflower, both federally listed as endangered, naked-stemmed buckwheat, host plant for the endangered Lange's metalmark butterfly, telegraph weed (Heterotheca grandiflora), Senecio flaccidus var. douglasii, deerweed (Lotus scoparius) and many others (Refer to Appendix D of the Draft CCP). In the disturbed, grassland, and vineyard areas there is an abundance of non-native species including rip-gut brome grass, yellow starthistle, Russian thistle (Salsola tragus), as well as some native species.

The Refuge provides important habitat for many types of wildlife including: nesting and migratory bird species and the California legless lizard (Aniella pulchra pulchra).

Section IV: ENVIRONMENTAL CONSEQUENCES

The principal environmental and socioeconomic effects are outlined in Table 1 and discussed in the following text.

A. No Action Alternative

The no action alternative would result in non-native vegetation continuing to inhibit the survival of endangered species at the Refuge. The Antioch dunes evening primrose would continue to decrease and the currently stable populations of Contra Costa wallflower and naked-stemmed buckwheat (host plant for the Lange's metalmark butterfly) could begin to decline. As non-native species encroach, the potential for a devastating wildfire increases.

If additional non-native vegetation control measures are not taken now, the problem will only be exacerbated, non-native species will increase, and more frequent and costly control measures could have to be taken in order to halt the spread of non-native species. Under the No Action alternative, there is high potential that the Antioch dunes evening primrose would be eliminated from its historic range. This inability of the Refuge to provide suitable habitat for endangered species is inconsistent with the Refuge's goals and conflicts with Service goals of recovering endangered species.

B. Prescribed Burning Alternative

Cut firelines, existing roads, and other control techniques that will be utilized to prevent escaped burns will prevent the escape of fire into areas where concentrations of endangered species occur. The selection of, and adherence to, a proper prescription and careful coordination with the Bay Area Air Quality Management District, the Contra Costa Fire Department, Service Ecological Services Office, and Service Regional Fire Management Officer will greatly limit the chance of an escaped burn.

For the first three years, the large burn plot areas within the Refuge will be carefully selected to avoid endangered species. However, a few primrose, wallflower, and buckwheat plants could be within a burn area and would be temporarily adversely affected. The Lange's metalmark butterfly may be detrimentally affected by burning its host plant, naked stemmed buckwheat. The small burn plots will be selected to contain a few endangered species so that we can closely monitor their response to fire. These species would be temporarily adversely affected. During the first three years, only buckwheat that was hand planted by the Service approximately five years ago and poor butterfly production stands will be burned. A Section 7 consultation has been requested.

Proposed burn areas will be thoroughly surveyed for any native bird nests prior to burning. If any nests are found, these areas will not be burned.

On a long-term scale, endangered and other native species will benefit from the removal of exotic species. Also, habitats, including designated critical habitat for the primrose and wallflower, will be enhanced. If burning non-native vegetation proves successful at restoring native and endangered species habitat, further large plots and small experimental plots will be selected for burning. If endangered species respond favorably to burning methods, areas will be burned on a continual, rotational basis. High butterfly producing stands and areas with high density of endangered and native species will not be selected for burning methods of vegetation control. These sensitive areas will continue to be maintained through hand-weeding efforts.

Prescribed burning will entail some economic costs to the Service; however, this is considered the most cost effective method to remove large areas of exotic vegetation. The aesthetic quality (scenery and odor) of the Antioch area will be temporarily altered because of smoke from the fire. However, prescribed burning will greatly mitigate potential future negative impacts resulting from wildfires by reducing a thick fuel layer.

Under Federal ownership, archaeological and historical resources within the Refuge receive protection under Federal laws mandating the management of cultural resources, including, but not limited to, the Archaeological Resources Protection Act; the Archaeological and Historic Preservation Act; the Native American Graves Protection and Repatriation Act; and the National Historic Preservation Act. The Service shall take all necessary steps to comply with section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended for the prescribed burning alternative.

C. Increased Weeding Effort Alternative

In some locations, this alternative would remove non-native vegetation and produce desired results. Endangered species, species of special concern, critical wildlife habitat, species diversity/abundance, and non-game species would all be positively affected by increased manual removal of non-native vegetation.

However, this would not fully solve the problems because manual removal of non-native vegetation would require a long period of time due to the large size of areas that need to be weeded and does not remove the non-native seed bank. During this period, the Antioch Dunes evening primrose could continue to decline and other currently stable species could begin to decline.

The Refuge would require two to three additional full time staff members to assist with non-native vegetation removal. This would require substantial additional funding.

D. Grazing Alternative

Endangered species, species of special concern, critical wildlife habitat, species diversity/abundance, and non-game species may be positively affected by cattle grazing due to the decrease in non-native species. However, this method would not effectively remove the non-native seed bank which may detrimentally affect endangered species. Additionally, if cattle escaped fenced areas they could cause vehicular highway accidents.

It would be difficult to contain cattle in areas devoid of endangered species. If cattle escaped from fenced areas they could severely detrimentally impact endangered and other native species at the Refuge by trampling them or directly consuming them. Since the only source of water for the cattle is the river, this alternative could result in detrimental impacts to the Mason's lilaeopsis, which grows in the littoral zone.

Because of the need to closely manage cattle rotations and the poor quality of forage, it would be difficult to find a rancher willing to meet these stringent requirements for such a small area. Grazing would require funds for the purchase and maintenance of fencing, and potentially for a contract with a cattle operator. The Refuge would require additional full time staff members to manage the grazing program.

E. Heavy Equipment Alternative

Endangered species, species of special concern, critical wildlife habitat, species diversity/abundance, and non-game species would all be positively affected by increased removal of non-native vegetation. Endangered species and species of special concern will be detrimentally affected if they are within a work site. Sites would be selected to minimize impacts to these species. Heavy equipment could not effectively remove the non-native seed bank which may detrimentally affect endangered species.

The Service shall comply with NHPA in the same manner as stated in Alternative B.

Section V: CONSULTATION AND COORDINATION WITH OTHERS

All Refuge prescribed burns would be conducted under the restrictions imposed by the Bay Area Air Quality Management District, the Contra Costa Fire Department, Fish and Wildlife Service Ecological Services Office, and the mandates of a Service Regional Fire Management Officer from preapproved plans by regional and on site biologists, to minimize any potential for negative impacts. The following ecologists were consulted in order to determine the optimum type and timing of the burn in order to eliminate exotic vegetation while enhancing endangered species habitat: Joseph DiTomaso (University of California, Davis), John Rusmore (UC Davis), John Randall (UC Davis), Bruce Pavlik (Mills College) and Martha Hastings (California Department of Parks and Recreation.

A public notice was advertised in two newspapers, the Antioch Ledger and the Contra Costa Times, for three days to notify the public of the availability of the Draft Environmental Assessment and the 30 day comment period.

During a 30 day comment period, the draft Environmental Assessment was sent to the California Clearing House, Pacific Gas & Electric, Santa Fe Railroad, City of Antioch Public Works, Contra Costa Fire Department, Georgia Pacific Gypsum, Current Resident of 1805 Wilbur Ave, and Kemwater.

We received one comment from Georgia Pacific Gypsum regarding concerns of employee smoke exposure. We subsequently worked with them to resolve their concerns.

Prepared by: Erin Fernández
Title: Wildlife Biologist
Duty Station: San Francisco Bay National Wildlife Refuge Complex

Contributors: Harvey Hill, Deputy Project Leader
San Francisco Bay National Wildlife Refuge Complex

Margaret Kolar, Project Leader
San Francisco Bay National Wildlife Refuge Complex

Roger Wong, Fire Management Officer
San Luis National Wildlife Refuge Complex

Betsy Radtke, Refuge Manager
San Francisco Bay National Wildlife Refuge

Section VI: CONCLUSION AND RECOMMENDATIONS

Based on the analysis contained in this document, I find that implementation of the proposed action is compatible with the major purposes for which the Refuge was established. Alternative B (prescribed burning) will improve habitat for endangered species and other wildlife in a cost effective manner. Therefore, Alternative B is the preferred alternative. Should the window of opportunity to burn at Antioch be missed in a given year, Alternative E (heavy equipment) is the preferred backup alternative. It would not constitute an action significantly affecting the quality of the human environment and therefore, I recommend that a Finding of No Significant Impact (FONSI) be prepared.

Douglas L Rader
Acting Project Leader

6/4/97
Date

Associate Manager

6/13/97
Date

LITERATURE CITED

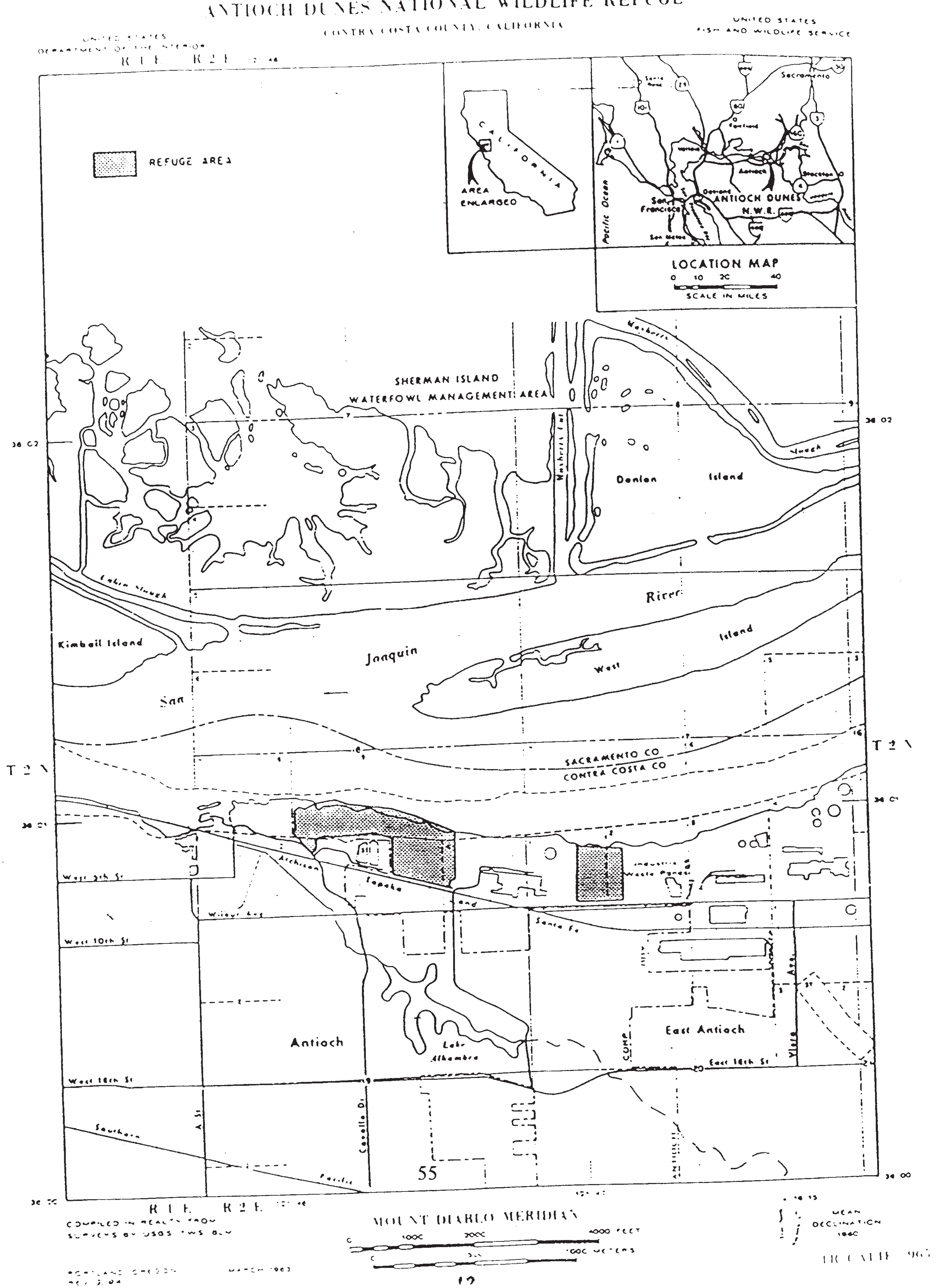
Green, J.A. 1995. Three reproductive ecology studies in the narrow endemic Oenothera deltoides ssp. howellii (Onagraceae). M.A. Thesis, Claremont Graduate School.

Bailey, R.G. 1995. Description of the ecoregions of the United States. USDA Forest Service. 108 pp.

Table 1. Alternative Matrix

Principal Environmental Effects	No Action	Prescribed Burn	Increased Weeding Effort	Grazing	Heavy Equipment Alternative
Threatened and Endangered Species	High	Low	Low	Moderate	Low
Species of Special Concern	High	Low	Low	Moderate	Low
Principal Socioeconomic Effects					
Refuge Operating Costs	None	Low	High	Moderate	Low
Aesthetics (scenery and odor)	None	Low	None	Low	None

Figure 1


ANTIOCH DUNES NATIONAL WILDLIFE REFUGE
CONTRA COSTA COUNTY, CALIFORNIA
UNITED STATES
DEPARTMENT OF THE INTERIOR
UNITED STATES
FISH AND WILDLIFE SERVICE
R 1 E
R 2 E
REFUGE AREA
CALIFORNIA
AREA ENLARGED
Sacramento
Pacific Ocean
San Francisco
Antioch
Stockton
ANTIOCH DUNES N.W.R.
LOCATION MAP
SCALE IN MILES
SHERMAN ISLAND
WATERFOWL MANAGEMENT AREA
Donlon Island
Kimball Island
San Joaquin River
West Island
SACRAMENTO CO
CONTRA COSTA CO
T 2 N
Atchison Topeka and Santa Fe
West 9th St
Wilbur Ave
West 10th St
Industrial Waste Ponds
Antioch
Lake Alhambra
East Antioch
West 18th St
East 18th St
Southern Pacific
A St
Cavallo Rd
MOUNT DIABLO MERIDIAN
COMPILED IN REALTY FROM SURVEYS BY USGS FWS BLM
4000 FEET
1000 METERS
MEAN DECLINATION 1960
PORTLAND OREGON
MARCH 1963

Attachment A

ANTIOCH DUNES
April 26, 1992

(NOTE: Nomenclature is according to A California Flora and Supplement by P. Munz and D. Keck, University of California Press, Berkeley, 1973)

Achillea millefolium
Alnus rhombifolia
Amaranthus albus
Ambrosia sp.
Amsinckia intermedia
Artemisia douglasiana
Arundo donax
Asparagus officinalis
Aster chilensis var. lentus
Atriplex patula ssp.hastata
Avena fatua
Baccharis pilularis ssp. consanguinea
Baccharis viminea
Bambusa sp.
Bidens laevis
Brassica geniculata
Bromus diandrus
Bromus mollis
Bromus rubens
Calystegia sepium ssp. limnophila
Carex sitchensis
Centurea solstitialis
Cephalanthus occidentalis var. californicus
Chenopodium sp.
Chrysopsis villosa var. echioides
Clarkia unguiculata
Cortaderia selloana
Croton californicus
Cynodon dactylon
Deschampsia cespitosa ssp. holiciformis
Distichlis spciata var. stolonifera
Elymus triticoides
Epilobium paniculatum
Epilobium sp.
Eriogonum nudum ssp. auriculatum
Erodium botrys
Erodium cicutarium
Eryngium articulatum
Erysimum capitatum var. angustatum
Eschscholzia californica var. crocea
Festuca megalura
Festuca sp.
Filago gallica
Foeniculum vulgare
Galium aparine
Galium sp.
Geranium dissectum
Gilia capitata ssp. staminea
Gnaphalium sp.
Grindelia camporum
Grindelia humilis
Gutierrezia californica
Helenium bigelovii
Heliotropium curassavicum var. oculatum
Heterotheca grandiflora
Hordeum brachyantherum
Hydrocotyle verticillata
Hypochoeris glabra
Hypochoeris radicata
Iris pseudacorus
Juglans hindsii
Juncus balticus
Juncus bufonius
Lactuca serriola
Lasthenia californica
Lathyrus jepsonii ssp. jepsonii
Lavatera cretica
Lepidium latifolium
Lilaeopsis masonii
Lolium multiflorum
Lotus purshianus
Lotus scoparius
Lotus subpinnatus
Ludwigia peploides
Lupinus albifrons
Lupinus bicolor ssp. pipersmithii
Lupinus bicolor ssp. umbellatus
Lupinus micranthus (?)
Lupinus succulentus
Lythrum californicum
Marah fabaceus
Medicago polymorpha
Melilotus albus
Melilotus indicus
Micropus californicus
Nicoiana glauca
Oenanthe sarmentosa
Oenothera deltoides var. howellii

Oenothera hookeri
Oenothera micrantha (? var.)
Panicum capillare var. occidentale
Phalaris canariensis
Phragmites communis var.
berlandieri
Plantago coronopus
Plantago lanceolata
Polygonum sp.
Populus fremontii
Portulaca oleracea
Potentilla edgedii
Prunus amygdalus
Prunus spp.
Psoralea macrostachya
Quercus agrifolia
Raphanus sativus
Robinia pseudo-acacia
Rosa californica
Rubus procerus
Rubus ursinus
Rumex crispus
Salix hindsiana
Salix lasiandra
Salix lasiolepis
Salsola kali var. tenuifolia
Sambucus caerulea
Scirpus californicus
Scirpus cernuus var. californicus
Senecio douglasii
Senecio vulgaris
Silene gallica
Sisybrium altissimum
Sonchus asper
Sonchus oleraceus
Stachys albens
Tillaea erecta
Toxicodendron diversilobum
Tragopogon porrifolius
Typha angustifolia
Typha domingensis
Ulmus parvifolia
Vicia angustifolia
Vicia dasycarpa
Vitis sp.
Xanthium strumarium var. canadense

RARE PLANTS reported to be at ANTIOCH DUNES

The following rare and endangered plants occurred historically at Antioch Dunes. Those with asterisks were seen on the CNPS Surveys done April 26 and May 16, 1992. It is unknown if the others still occur at the Dunes, but should be looked for on future surveys.

Species

*Aster lentus

Cryptantha hooveri

Elocharis parvula

*Erysimum capitatum angustatum

Eschscholzia rhombipetala

*Grindelia humilis

Lasthenia conjugens

*Lathyrus jepsonii ssp. jepsonii

*Lilaopsis masonii

Madia radiata

*Oenethera deltoides ssp. howellii

Particularly common or troublesome weeds.

Avena fatua (Wild Oats)
Brassica sp. (Mustard)
Bromus diandrus (=B. rigidus) (Ripgut Grass)
Centaurea solstitialis (Yellow Star Thistle)
Conyza canadensis (Horseweed)
Cortaderia selloana (Pampas Grass)
Cynodon dactylon (Bermuda Grass)
Erodium cicutarium (Filaree)
Foeniculum vulgare (Fennel)
Lactuca serriola (Prickly Lettuce)
Lepidium latifolium
Marrubium vulgare (Horehound)
Melilotus albus (Sweet Clover)
Melilotus indicus (Sour Clover)
Medicago hispida (Bur Clover)
Poa pratensis (Kentucky Bluegrass)
Rubus discolor (=R. procerus) (Himalaya-Berry)
Raphanus sativus (Wild Radish)
Salsola iberica (Russian Thistle) (=S. kali var. tenuifolia)

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
Region 1, Portland, Oregon

FINDING OF NO SIGNIFICANT IMPACT

Final Environmental Assessment
for
Prescribed Burning of Dune Areas on
Antioch Dunes National Wildlife Refuge
Contra Costa County, California
P.O. Box 524
Newark, California 94560

The U.S. Fish and Wildlife Service has prepared an Environmental Assessment to evaluate the effects associated with prescribed burning on the Antioch Dunes NWR.

The U.S. Fish and Wildlife Service proposes to conduct an on going program of prescribed burning with a back up of heavy equipment use to restore dune habitat for endangered and other native species. Prescribed burns may be utilized throughout parts of the Refuge and will result in a significant decrease in the amount of non-native vegetation as well as an increase in native and endangered species with minimum costs economically and environmentally. The effects of burning on endangered and native species will be closely monitored. If burning proves beneficial, it will be continued on an on going rotational basis. If the window of opportunity to burn is missed in any given year, heavy equipment will be used as a back-up means to remove non-native vegetation as described in Alternative E.

The U.S. Fish and Wildlife Service has analyzed a number of alternatives to the proposal, including the following:

A) No Action
B) Prescribed Burning (Preferred Alternative)
C) Increased Weeding Effort
D) Cattle Grazing
E) Heavy Equipment Use

The preferred alternative was selected over the other alternatives because:

Prescribed burning is the most effective method to remove large amounts of non-native vegetation and the non-native seed bank. Other alternatives evaluated would not be effective in removing the seedbank. It is the most cost effective alternative and has minimal environmental and socioeconomic impacts.

Implementation of the preferred alternative would be expected to result in the following environmental and socioeconomic effects:

Study of the environmental effects of the proposal has shown that the preferred alternative could impact some individual plants of the Antioch dunes evening primrose, Contra Costa wallflower, and the naked stemmed buckwheat (host plant to the Lange's metalmark butterfly). However, the long-term effects will be beneficial to these species because a significant amount of non-native vegetation will be removed which will decrease competition between these species.

The aesthetic quality (scenery and odor) of the Antioch area will be temporarily altered because of smoke from the fire. Escaped fire could threaten endangered species and their habitat, private property, and public safety.

Measures to mitigate and/or minimize adverse effects have been incorporated into the proposal. These measure include:

Measures to mitigate and/or minimize adverse effects have been incorporated into the proposal. These measures include: 1) close coordination with the Service Regional Fire Management Officer, Contra Costa Fire Department, Bay Area Air Quality Management District, and the Service Ecological Services Office; 2) selection of a proper burn prescription and cessation of burn activities when conditions exceed predetermined prescription levels; 3) the utilization of firebreaks (cut line, existing roads) around burn units to minimize any potential for wildfire.

Prescribed burning will greatly mitigate potential future negative impacts resulting from wildfires by reducing a thick fuel layer

The proposal is not expected to have any significant effects on the quality of the human environment because:

The action would have a beneficial effect on endangered and native species and their habitat on a long-term scale. The action would not degrade habitats, water, or air quality, and would not disrupt or conflict with any land use, social, cultural or economic factors.

Public Availability

A public notice was advertised in two newspapers, the Antioch Ledger and the Contra Costa Times, for three days to notify the public of the availability of the Draft Environmental Assessment and the 30 day comment period.

During a 30 day comment period, the draft Environmental Assessment was sent to the California State Clearing House, Pacific Gas & Electric, Santa Fe Rail Road, City of Antioch Public Works, Contra Costa Fire Department, and G.P. Gypsum. Their comments were considered in the formation of the final Environmental Assessment.

Determination

Based on review and evaluation of the information contained in the Environmental Assessment, the U.S. Fish and Wildlife Service has determined that the proposed activity is not a major Federal action which would significantly affect the quality of the human environment within the meaning of Section 102 (2)(c) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an Environmental Impact Statement on the proposed action is not required.

Issued in Portland, Oregon, June 13, 1997

Acting Regional Director JOHN H DOEBEL

6/13/97
Date

United States Department of the Interior

FISH AND WILDLIFE SERVICE, REGION 1
Cultural Resource Team
c/o Tualatin River National Wildlife Refuge
20555 SW Gerda Lane
Sherwood, Oregon 97140
503-625-4377 (fax 503-625-4887)

May 28, 1997

To: Erica Fernandez
Antioch Dunes NWR

From: Anan Raymond
Regional Archaeologist

Subject: Section 106 compliance, Prescribed Burn

We have attached a copy of the cover page(s) of the cultural resource compliance request form(s) that you recently submitted to us. We have reviewed the form(s), applied the Programmatic Agreement, and marked the cover page(s) accordingly.

"Appendix A" applies to a project, you may proceed without further cultural resource consultation.

Thank you for considering cultural resources.

REQUEST FOR CULTURAL RESOURCE COMPLIANCE

Project Name: **Antioch Dunes NWR Prescribed Burn Project**

USFWS Unit: (Office Name and/or Org Code) **Antioch Dunes NWR**

Ecoregion: (By ARD: CSE, IPE, NCE, NCE)

Program: **Refuges**

(Partners, WSECP, Refuges, Hatcheries, Jobs, Chehalis RD, Federal Aid, Private Lands, Realty, Other)

NHPA COMPLIANCE

☑ Cleared under Appendix A Item 2
of the Programmatic Agreement.

☐ 36CFR800.4 to 800.6 applies.

Anan Raymond 5.28.97
Cultural Resources Team Date

Location: (nearest town) Antioch County: Contra Costa State: CA

2N	2E	17, 18	~~Mount Diablo~~ Antioch North
Township(s)	Range(s)	Section(s)	7.5' USGS Quad(s): Name, date

Project acres or linear meters/feet: approximately 12

Date you want to start the project: June 1, 1997

Date of this request: May 1, 1997

USFWS Contact: Erin Fernandez

Phone: (510)792-0222

Address: PO Box 524
Newark, CA 94560

Fax: (510)792-5828

Attach to this form:
- A project (sketch) map showing the Area of Potential Effect with locations of specific ground altering activities *(required)*.
- A photocopy of the USGS quad clearly marking the project area *(required)*.
- A photocopy of an air photo showing the project may be attached *(if available)*.

Directions to project: *(if not obvious)*

The Undertaking: *Describe the proposed project and means to facilitate it (e.g., provide funds to revegetate 1 mile of riparian habitat, restore 250 acres of seasonal wetlands, and construct a 5-acre permanent pond). How is the project designed (e.g., install 2 miles of fence and create approximately 25 feet of 3 foot high check dam)?*

The Service proposes to conduct a prescribed burn and/or use heavy equipment to restore dune habitat for endangered species at Antioch Dunes NWR. Burning and/or mowing/disking/plowing will help to control non-native vegetation that is outcompeting endangered species. The first year, we propose to burn three, approximately three acre sites in addition to 15 small experimental plots. If the acceptable window of opportunity to burn is missed, we will use heavy equipment to control non-native vegetation. Please see the attached draft environmental assessment for further detail.

February 20, 1997

MEMORANDUM

To: Field Supervisor, Ecological Services, Sacramento, CA

From: Refuge Manager, San Francisco Bay NWR Complex S.F., CA

Subject: Review of the Intra-Service Section 7 Evaluation Form for prescribed burning at Antioch Dunes NWR

We are proposing to conduct prescribed burning and mowing/disking/plowing at Antioch Dunes NWR to control non-native vegetation and enhance endangered species habitat. All pertinent information related to endangered species is contained in this document. The Final Prescribed Fire Plan, which addresses the technical aspects and human safety issues of prescribed burning will follow later.

If you have any questions regarding this activity or its impacts, please contact Erin Fernández of my staff at (510) 792-0222.

Margaret T. Kolar

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services

Sacramento Field Office

3310 El Camino Avenue, Suite 130

Sacramento, California 95821-6340

REPLY REFER T0: 1-1-97-F-0075

June 11, 1997

Memorandum

To: Refuge Complex Manager, San Francisco Bay National Wildlife Refuge Complex, U.S. Fish and Wildlife Service, Newark, California

From: Field Supervisor, U.' S. Fish and Wildlife Service, Ecological Services, Sacramento Field office, Sacramento, California

Subject: Section 7 Consultation on Prescribed Burning and Mowing, Disking, or Plowing at the Antioch Dunes National Wildlife Refuge, Antioch, Contra Costa County, California

This memorandum is in response to your request for formal consultation on a plan to conduct prescribed burns and mechanical control of non-native vegetation at the Antioch Dunes National Wildlife Refuge (Refuge) of the San Francisco Bay National Wildlife Refuge Complex. Your memorandum, dated March 5, 1997, was received in this office on March 7, 1997. This document represents the U. S. Fish and Wildlife Service's (Service) biological opinion on the effects of the proposed action on the Lange's metalmark butterfly *(Apodemia mormo langei),* the Contra Costa wallflower *(Erysimum capitatum* var. *angrustatum) , and* the Antioch Dunes evening primrose *(Oenothera deltoides ssp. howellii) , in* accordance with section 7 of the Endangered Species Act of 1973, as amended ("Act"; 16 U.S.C. 1531 et seq.) . For brevity below, the word "butterfly" is sometimes omitted from the common name of the butterfly, as is common practice.

This consultation is based on information from the Intra-Service Section 7 Evaluation Form, dated February 20, 1997, the Prescribed Fire Plan, (undated, received April 4, 1997), discussions between Erin Fernandez of the Refuge and David Wright, Peter Baye, Nancy Kang, and Kirsten Tarp of my staff, site visits, Service files, and other sources of information. A complete administrative record of this consultation is on file in this office.

BIOLOGICAL OPINION

Description of the Proposed Action

The Service proposes to burn, and mow, disk, or plow, at the Antioch Dunes National Wildlife Refuge (part of the San Francisco Bay National Wildlife Refuge Complex) , to control non-native plant species and enhance habitat for

three endangered species: Antioch Dunes evening-primrose, Contra Costa wallflower, and Lange's metalmark butterfly. The proposed actions would take place on both the Stamm and Sardis units of the Refuge.

The 55-acre Refuge was established to protect a unique riverine dune ecosystem, which in addition to adjacent Pacific Gas and Electric Company (PG&E) land, supports the last natural populations of the Contra Costa wallflower and Lange's metalmark. only a few small populations of Antioch Dunes evening-primrose occur outside of the Refuge. Historically, many factors have contributed to the decline of these species, including human development and sand mining of the dunes. Currently, however, the primary threat to these species is the encroachment of non-native vegetation such as ripgut brome grass *(Bromus diandrus)* and yellow star-thistle *(Centaurea solstitialis)* Refuge staff actively manage the resident endangered species by conducting annual population surveys and restoring habitat. Management tools include the Exotic Vegetation Management Program, which currently includes hand pulling and herbicide treatment of non-natives. Despite management efforts, non-native plant species continue to out-compete native species, such as the endangered primrose.

In order to restore endangered and native species habitat, the Refuge proposes to improve and extend its exotic vegetation management activities. After consulting with ecologists, including Joseph DiTomaso (University of California, Davis) , John Rusmore (UC Davis) , John Randall (UC Davis) , Bruce Pavlik (Mills College) and Martha Hastings (California Department of Parks and Recreation), prescribed burning and mowing/disking/plowing were identified as techniques for restoring habitat at the Refuge and creating more suitable habitat for endangered and native species, which are dependent on the historic open, sand dune environment. Burning and mowing /disking/p lowing would remove non-native vegetation, and may subsequently decrease competition between endangered and exotic species. Burning was selected as the preferred method of non-native vegetation removal because it reduces the non-native seed bank at a faster rate than mechanical methods. However, if burning were not conducted during the acceptable burn window in any given year, the Refuge would use mowing, disking, or plowing methods to control non-native . vegetation. This would remove the non-native vegetation and prevent it from adding further to the non-native seed bank-in that year. Mowing/disking/ plowing would be conducted in the same locations and monitored in the same way. as burning. The proposed work would assess whether these weed-control techniques are an effective way to stabilize and increase populations of endangered species.

Selected dune sites of manageable size would be burned under predetermined conditions, every year or every other year, in order to remove non-native vegetation until the non-native seed bank is exhausted. Burning would then be conducted on an as-needed basis. During the first year, the Refuge proposes to burn three sites on the Refuge that are dominated by non-native vegetation, have very few natives, and few individuals of endangered species or their host plants. Refuge staff would establish non-burned control plots similar in vegetative composition to the burn areas. The Refuge would monitor both control and non-control areas for species richness and percent cover before

and after the burn. Data from before and after the burn would be analyzed, and control areas would be compared to burned areas in order to determine the response of non-native vegetation to fire. The Refuge would plant native and endangered species in these areas after the non-native seed bank has been substantially diminished, which may take up to three years of burning. If this method proves successful, further areas would be burned on a rotational basis and subsequently replanted with native and endangered species.

The three areas proposed for burning are the "triangle hard pan" (3 acres) and "old vineyard" (5 acres) areas of the Stamm Unit (Figure 1), and the "south plateau" (4.25 acres) of the Sardis Unit (Figure 2). Dominant plants of these areas include non-native annual grasses, yellow star-thistle, Russian thistle (*Salsola tragus*) , and yellow bush lupine (*Lupinus arboreus*) , a native species that can become excessively abundant and reduce diversity of rare or other native plants. Burn objectives would be to blacken 80-100% of the target areas, consuming 80-100% of standing vegetation and litter.

Great care would be -taken to ensure that fire does not escape the treatment areas. Cut fire lines and existing roads would be used to prevent escaped burns. The Refuge would select and adhere to a proper fire prescription, and would coordinate fully with the Bay Area Air Quality Management District, the Contra Costa Fire Department, and the Service's Regional Fire Management officer, which would limit the threat of fire escape.

The Refuge also proposes to burn 15 small experimental plots (7 square m eters each) containing primrose and buckwheat, in order to test the response of primrose and buckwheat to fire. This would be done through the use of a burn box in which a small fire hot enough to scorch the existing vegetation can be contained. Ten of the plots would have one to two primrose, a few natives and many non-natives. Five of the plots would contain buckwheat in order to test the response of buckwheat to fire. Refuge staff would establish-15 non-burned control plots similar in vegetative composition to the burn areas and monitor these areas for species richness and percent cover before and after the burn. Data from before and after the burn would be analyzed, and control areas would be compared to burned areas in order to determine the response of native and non-native vegetation to fire.

The Refuge would monitor prescribed burn plots by recording environmental. factors and locating sites with a Global Positioning System. Variables monitored would include native and non-native species richness and percent cover before and after the burn, to compare control areas to burned areas, as well as to track annual progress of the sites. Refuge staff would use a combination of line transects and fixed plots to monitor vegetation. Vegetation would be monitored both in the middle of burn plots and toward the edges, to detect differences in the amount of non-native vegetation resprouting from the residual seed source versus the amount encroaching on the burn area from the periphery.

Burning would be ideally conducted in May or June in order to achieve two primary objectives: kill the existing non-native plants and their seed heads, and exhaust the non-native. seed bank. In May and June, the grasses are dry

enough to carry a hot fire, which is required to destroy the non-native seed bed and the seed heads. Yellow star-thistle should be under 5% flower at this time. This is the optimum time to burn it because the fire would destroy the thistle before it produces seed, yet it will have expended enough energy that it should not regrow in that season. Burning might be done at a less optimal time ranging from spring through fall, depending on allowable burn days.

All Refuge prescribed burns would be conducted under the restrictions imposed by the Bay Area Air Quality Management District, the Contra Costa Fire Department, and the mandates of a Service Regional Fire Management officer, from pre-approved plans by regional and on-site biologists, to minimize any potential for negative impacts.

Status of the Species

The ranges and total populations of the species considered in this biological opinion have been lowered drastically by human activities. Sand mining, urban development, and invasion of non-native plant species have reduced the size and functionality of the dune ecosystem at Antioch Dunes. The Antioch Dunes probably once totaled roughly 200 acres (USFWS 1984), and adjacent sandy, nondune areas may have provided additional habitat. Now largely restricted to the Refuge and adjacent PG&E parcels, the dunes have been reduced to about 70 acres in extent. Even within the Refuge, the dunes have in the past been altered by sand mining and other human uses, and stabilized by plant growth. Stabilization can be detrimental to species which are adapted to the shifting sands typical of dunes. sand mining and urban development have resulted in habitat loss and fragmentation, and sand mining has caused gross loss of the soil substrate necessary for the development of the habitat. The former dune area has little topographic relief compared with historic conditions.

Introduction of invasive non-native plants, accelerated by grazing practices and sometimes by planting, has greatly altered California ecosystems and resulted in the widespread replacement of native plants,, especially in grasslands. Many of these invasive plants, some of which are present in the action area (for example, yellow star-thistle, ripgut brome, and Russian thistle), are capable of choking out or shading out the listed plant species and butterfly host plants.

Lange's metalmark butterfly

On June 1, 1976, Lange's metalmark was listed as an endangered species (41 FR 22044-22141). Critical habitat was proposed in 1977 (42 FR 7973) but never designated.

Lange's metalmark butterfly *(Apodemia mormo langei*)was discovered and named in 1938 as a result of entomological studies on the Antioch Dunes. It is a distinctive subspecies of the more widely distributed species *Apodemia mormo*, found in Mexico and the western United States (Opler & Powell *1962)* . Lange’s metalmark is restricted to the Antioch Dunes, which are now themselves largely restricted to the Refuge. The resent range of Lange's metalmark has been

reduced to about 70 acres, approximately corresponding to the Refuge and nearby areas.

Lange's metalmark is a fragile, medium-sized butterfly; brightly colored in orange, black, and brown with white spots. Unlike some butterfly species, Lange's metalmark has only one generation each year. All of the life stages of the butterfly are found in close proximity to the sole larval food plant, a subspecies of naked buckwheat (*Eriogonum nudum ssp. auriculatum*) . The eggs are laid on the withered buckwheat during the adult flight season, which occurs from the latter half of July through September. The eggs hatch after the winter rains begin; and the larvae crawl to the base of the plant where they overwinter and feed, if new foliage is available (Arnold 1980) . Pupation takes place in early to mid-summer in the litter at the base of the buckwheat, with the adults emerging in late summer (USFWS 1984) . The adult butterflies prefer naked buckwheat flowers as nectar sources and as perches, but use other flowering plants as well. Lange's metalmarks also use silver bush lupine, *Lupinus albifrons*, for cover during mating. Both sexes are capable of flying from a few to more than a hundred meters between perches (USFWS 1984). Individual adults live approximately one week; and the fecundity of wild females is low.

Arnold's annual report of January 15, 1986, to the Refuge indicated a slight increase in the population of the butterfly since 1977. From 1986 to 1991, the population increased exponentially, from approximately 160 butterflies counted in 1986 to nearly 2000 butterflies counted in 1991. In 1992, the population fell to about 1/3 of the previous year's peak level, but by 1996 had recovered to in excess of 2000 butterflies counted on the Refuge and the adjacent PG&E parcels. In the past, about 2/3 of adult individuals were counted on the western or Stamm Unit of the Refuge, and about- 1/3 on the eastern or Sardis Unit. In 1996, however, counts in the Stamm and Sardis units were more equal (USFWS 1996).

Lange's metalmark counts are not 'available for the large areas proposed for burning in 1997, the Stamm "old vineyard" and "triangle hard pan" (Figure 1) and the Sardis "south plateau" (Figure 2). These areas do not support any significant number of host buckwheat plants, and experience suggests that adult metalmark densities there are very low. A few scattered buckwheat plants (less than 10) occur in the old vineyard, among the grasses and star thistle, and no buckwheat are found in the other two burn areas (Erin Fernandez, personal communication, June 9, 1997). A few metalmark adults may sometimes be present in the large proposed burn areas; these individuals are probably resting or moving through. No larvae or pupae are expected to be in these areas because of the lack of host plants.

Five of the small "burn box" plots would contain buckwheat plants, in order to test the response of the buckwheat to prescribed burning. These experimental plots may be expected to burn a total of 0.0086 acres containing a total of perhaps 75 to 100 buckwheat plants. A few Lange's metalmark larvae or pupae may be exposed to fire by these experiments. Their likelihood of surviving is unknown, and would depend on the depth of soil covering them, if any, and the heat and duration of the fire.

Invasive non-native plants such as ripgut brome and yellow star-thistle threaten the butterfly by competing with larval and adult food plants, inhibiting establishment of buckwheat and other native plant seedlings, and perhaps by adversely changing the microclimate experienced by the larvae at the base of their buckwheat hosts (USFWS 1984) . Fire, on the other hand, may have mixed effects on the butterfly. A "wildfire" in 1976 near the PG&E east tower destroyed most of a buckwheat stand and the butterfly larvae present. Since that time the buckwheat has recovered and metalmarks have been observed in the area (USFWS 1984). Prescribed burning can be a useful tool for controlling invasive weeds, especially if carefully timed to cause maximum impact to the invader and lesser impact to native plants. Follow-up after the burn is essential to eliminate germinating invasive plants and to exhaust the seed bank of invasive species.

Antioch Dunes evening-primrose

The Antioch Dunes evening-primrose was listed as endangered with critical habitat on April 26, 1978 (43 FR 17916) . Township and range description for critical habitat of the species is T2N, R2E, SW 1/4 of Section 17, and E 2/3 of S 1/3 of Section 18 (MDM), Contra Costa County, which includes the Refuge.

The Antioch Dunes evening-primrose is a short-lived perennial herb to subshrub with a fleshy taproot, forming large tufts with coarse drooping stems 4-8 dm long, much branched; leaves incised to sharply pinnatifid, lance-like in outline, 3-12 cm long, 1-3 cm wide, grayish with numerous short and fewer longer hairs; sepals 2-3 cm long, densely more or less glandular-pubescent and few to many fine wavy hairs 1-3 mm long, prominent free sepal tips in bud 1-3 mm long; petals 2-3 cm long; capsule 3-4 mm thick at base.

The historic range of the species is presumably limited to the sandy soil type (Oakley or Delhi sand) found at the Antioch Dunes and over. a substantial portion of eastern Contra Costa County. The evening -primrose now occurs in three general localities, all near the confluence of -the Sacramento and San Joaquin rivers. The only verified natural. stand of the species is within the sand dunes near Antioch in Contra Costa county. One recently discovered erratic population occurs at an abandoned sand quarry south of Cowell Road intersection at Ygnacio Road in Contra Costa. County. This anomalous population consists of a mixture of *Oenothera deltoides* sspp. *howellii* and *cognata* and apparent intermediates, possibly hybrids. This population is of recent and uncertain (possibly anthropogenic) origin.

The Service placed most of the natural Antioch dune habitat within its National Wildlife Refuge System with the purchase of two parcels in 1980. PG&E, Domtar Gypsum, and a local citizen own the remaining habitat harboring the Antioch Dunes evening-primrose.

The subspecies also has been introduced into at least three different localities by East Bay Regional Parks Botanic Garden personnel since 1970. James Roof, late Director Emeritus of the Garden, suggested a solution to the mining activities that were quarrying the remaining dunes prior to their acquisition by the Service (Roof 1969) . He believed the "dispersal to remote

dunes areas" might ensure the survival of the evening - primrose. As a result, Walter Knight, former staff member of the garden, sowed seed on "low dunes" at Brannan Island State Recreation Area in Sacramento County (Anonymous 1971). In addition, Roof introduced the subspecies onto the coastal dunes at Point Reyes National Seashore in Marin County (Anonymous 1971) Roof (1969) had discussed these two introduction sites as suitable sites for introduction of Oenothera seed. Although the experiment failed at Point Reyes, the subspecies became naturalized at Brannan Island and thrives there today. Knight also started two small colonies on Brown's Island in Contra Costa County in 1978. He believed the plant was doing well on the island; however, Alice Howard reported in 1982 that the evening-primrose appeared to be declining (USFWS 1984) . The species is also cultivated in natural dune soil at Strybing Arboretum in Golden Gate Park, San Francisco, where it has a weedy, invasive habit.

Primrose numbers on the Refuge have decreased substantially in recent years. There were 5,800 mature primrose in 1984, 1468 in 1995, 963 in 1996, and only 455 mature primrose in 1997, a decrease of 92% in just over a decade (Erin Fernandez, pers. comm., June 9, 1997) . The primrose appears particularly vulnerable to exotic vegetation encroachment. Green (1995) found no primrose seedlings around mature primrose that were surrounded by weed species, yet seedlings were found around 40% of mature primrose that were not surrounded by weed species.

Anecdotal evidence suggests that the Antioch Dunes evening-primrose may benefit from certain forms of disturbance. Primrose were seeded successfully in an area accidentally burned in 1985, resulting in record populations in the 198G and 1987 censuses (USFWS 1987). The species is also reported to colonize disked areas (USFWS 1984).

Contra Costa wallflower

The Contra Costa wallflower was listed as endangered with critical habitat on April 26, 1978 (43 FR 17916). The designated critical habitat area is the same as that of the Antioch Dunes evening-primrose.

The wallflower is an erect, robust, coarse- stemmed, monocarpic perennial ("biennial") herb with simple or few branched stems 2-3 m tall; woody base (caudex) much- elongated and nearly 5 mm in diameter; basal leaves elongated lance-like to linear, tapering to a petiole at base and acute at apex; lowermost leaves 4-16 cm long 0.5-1 cm wide with minutely-toothed margins; flowers in unbranched stalks bearing flowers laterally from a lengthening tip; petals 4, yellow, 1.5-2 cm long; stamens 6 (4 long and 2 short)'; seed pods (siliques) 4-angled, stiffly ascending, slender, 5-10 cm long and usually under 2 mm broad.

Rossbach (1958) believed that the Contra Costa wallflower was "restricted to more or less consolidated dunes of fine sand and some clay" near Antioch, Contra Costa County. He said the habitat was covered "with sparse herbs and shrubs, or less often with pasture grasses, herbs, and scattered" live oaks (*Quercus agrifolia*). Johnson (1978) suggested that reproducing individuals

occurred principally on uneven sites (e.g., river bluff faces and edges). Pavlik and Manning (1993) concluded that optimal wallflower habitat consisted of steep, north-facing dune slopes with sparse vegetation cover and no exotic weeds. This is consistent with the original findings of the species, recovery plan and critical habitat designation,. which identified the essential role of relatively bare, mobile dune habitat for its regeneration. In this respect, it is ecologically similar to Antioch Dunes evening-primrose, which requires natural disturbances, sparse vegetation, and some dune mobility.

According to records in the California Natural Diversity Data Base (CDFG 1997), 234 wallflower plants were observed within the Refuge in 1978, 818 in 1984, 786 in 1985, and 2275 in 1991. This dramatic population increase has perhaps peaked in recent years: 10,870 in 1994, 7794 in 1995, and 11,337 in 199G (these last three censuses include the PG&E parcels) . In the 1997 census, 10,350 plants were counted, including 2239 on PG&E lands, primarily the east parcel (Erin Fernandez, pers. comm., June 9, 1997) . In all areas, the species is concentrated on north- and east-facing bluffs and around tower structures (CDFG 1997, PG&E 1996).

In the 1997 count, 79 Contra Costa wallflower plants were found in the Sardis south plateau burn area, representing somewhat less than it of the total population. No wallflowers occur in the other two proposed large burn areas, and none or very few would be expected in the burn boxes. Like the evening primrose, the wallflower was also reported to respond favorably following the accidental fire in 1985 (USFWS 1987).

Species of Concern

Several species of concern to the Service may occur or once occurred on the site, including Middlekauf shieldback katydid (*Idiostatus. middlekaufi*) Antioch cophuran robberfly (*Cophura hurdi*), Antioch efferian robberfly (*Efferia antiochi*), Hurd's metapogon robberfly (*Metapogon huidi*), Antioch mutillid wasp (*Myrmosula pacifica* [=Myrmosa p.1), Antioch sphecid wasp: (*Philanthus nasalis*), red-headed sphecid wasp (*Eucerceris ruficeps*), Antioch andrenid bee (*Perdita scitula antiochensis*), yellow-banded andrenid bee (*Perdita hirticeps luteocincta*), Antioch anthicid beetle (*Anthicus antiochensis*), Sacramento anthicid beetle (*Anthicus sacramento*), and the Ciervo aegialian scarab beetle (*Aegialia concinna*). Many of these species. are known only from the Antioch Dunes; many have not been seen for years. Virtually nothing is known about the population sites, life histories or habitat requirements of these species, other than that they may prefer sandy soils. It is reasonable to assume that most depend on the native dune ecosystem for their survival and reproduction, and that limited use of fire or other vegetation management activities may pose some small risk to portions of their populations if still present, especial ly if individuals are found within areas dominated by the non-native weeds that are targeted for management. Adverse impacts to species of concern are likely to be temporary, and the net effect of these experiments on restoring the native ecosystem is likely to be beneficial.

Environmental Baseline

Under the provisions of section 7(a)(2) of the Act, when considering the effects of the proposed action on listed species, the Service is required to consider the environmental baseline. The environmental baseline takes into account the past and present effects of human activities on the species in the action area. The action area is defined as including all areas to be affected directly or indirectly by the action, and not merely the immediate area involved in the action (50 CFR §402.02).

The action area of the proposed project is nearly the same as the range of the listed species considered in this opinion; so the environmental baseline (status of the species in the action area) is essentially the same as the overall status of the species, presented above.

Effects of the Proposed Action

If they are present in the treatment area, prescribed burning is likely to kill Lange's metalmark larvae and pupae and Contra Costa wallflower plants. Individuals of the Antioch Dunes evening-primrose and naked stemmed buckwheat (the metalmark host) may be killed, or in some cases their underground roots might survive and re-sprout. Some seeds of all three plant species would be likely to survive and benefit from the long-term effects of the fire. Prescribed burning could seriously threaten any of the endangered species or species of concern if the fire escaped a treatment area and burned a significant portion of the area it inhabited.

For the first three years, the large burn areas within the Refuge would be carefully selected to avoid endangered species. However, a few evening primrose, wallflower, and buckwheat plants could be within a burn area, and likely adversely affected. The Lange's metalmark butterfly could be detrimentally affected by burning its host plant, naked stemmed buckwheat. The small burn plots would be selected to contain a few endangered plant species so that Refuge staff can closely monitor their response to fire. These individuals would be adversely affected. The populations of these species would not be adversely affected in the long term by the burn box experiment, since it would be conducted in weed-dominated areas that would inhibit long-term regeneration of endangered species if left alone. For the first three years, only buckwheat planted by Refuge staff approximately five years ago, and which are poor butterfly production stands, would be burned.

Heavy smoke deposition on buckwheat stands downwind of the prescribed burns could inhibit the respiration and feeding of any Lange's metalmark larvae that have not yet pupated. The risk of serious impacts of smoke deposition appears to be small. If burning occurred during the flight season of the metalmark (July-September), adult butterflies might suffer respiratory effects, or might attempt to flee the area and be lost to the inhospitable environment surrounding the Refuge.

The net effect of repeated controlled burns on evening-primrose, wallflower, and metalmark populations would probably be beneficial, since it would probably suppress exotic weeds that inhibit growth of the endangered plants

and the host plant of the butterfly. However, it is also possible that the burn may stimulate weedy plant regrowth. Some species, such as yellow bush lupine (*Lupinus arboreus*) develop luxuriant vegetative growth from re-sprouts after burns, and also exhibit flushes of seed germination. After recent fires in the dunes at Limantour Spit in Point Reyes National Seashore, abundance of yellow bush lupine appeared to increase substantially. Although fire may reduce the density of weed seeds, residual weed seed shallowly buried below the soil surface may still be sufficient for robust recolonization of burned areas. Nutrients released by burns could also stimulate regrowth of weeds. This is particularly a risk for the first post-burn growing season.

On a long-term scale, endangered and other native species would benefit from the removal of exotic species. Also, habitats, including designated critical habitat for the primrose and wallflower, would be enhanced. If burning and mowing/disking/plowing methods of non-native vegetation control prove successful at restoring native and endangered species habitat, further large plots and smaller experimental plots would be selected for burning. if endangered species respond favorably to burning and mowing/disking/plowing methods, selected areas would be burned periodically. High butterfly producing stands and areas with *high density* of endangered and native species would not be selected for burning or mowing methods of vegetation control. These sensitive areas would continue to be maintained through hand-weeding efforts.

Species of special concern that may be affected include: California legless lizard *(Aniella pulchra pulchra), M*iddlekauf katydid *(Idiostatus middlekauffi),* Antioch Robber *Fly (Cophura hurdi),* Antioch vespid wasp *(Microdynarud arenicolus),* Antioch tiphiid wasp *(Myrmusula pacifica)*, Antioch sphecid *wasp (Philanthus nasalis),* yellow-banded andrenid wasp *(Perdita hirticeps luteocincta*), Antioch, andrenid bee *(Perdita- scitula antiochensis*) and all native bird species. The Refuge is currently monitoring the area to determine if these species are present. If any legless lizards were found in a proposed burn site, fire breaks would be cut around the area in order to protect the lizards. The Refuge has not recently found any of the above insect species, and some may be extinct. Proposed burn areas would be thoroughly surveyed for any native bird nests prior to burning. It any nests are found, these areas would not be burned.

Mowing/disking/plowing methods of non-native vegetation control pose less risk than prescribed burning because there is little danger of mowing outside of plot boundaries. Except for the absence of smoke-induced impacts, other effects of mechanical methods to listed and other native species would be similar to the impacts induced by burning.

Cumulative Effects

Cumulative effects are those impacts of future non-Federal (State, local government, and private) actions on endangered and threatened species or critical habitat that are reasonably certain to occur within the action area. Future Federal actions will be subject to the consultation requirements of

section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

The project area is limited to the Refuge. Since the Refuge is federally owned, all future proposed actions there will be subject to section 7 consultation and are not cumulative to the current action. Some individuals or populations of Lange's metalmark, Antioch Dunes evening-primrose, and Contra Costa wallflower occur outside the Refuge, on the adjacent PG&E lands and elsewhere. The Service is aware of a proposed cooperative agreement between the Refuge and PG&E that would address management of the PG&E lands. Because of the Refuge's involvement, this agreement would also be subject to Section 7 consultation.

Cumulative impacts to Antioch Dunes evening primrose are likely to occur as a result of the Summit Project development in Contra Costa County, where the outlier population of mixed probable hybrid and typical evening-primrose occurs in a former sand quarry. The probable hybrid status of the population, however, limits its long-term conservation significance for the species. Other non-Federal actions that the Service is currently unaware of could adversely affect the three listed species considered here. However, the proposed vegetation management is anticipated to have a net benefit for the endangered species, which would help offset external cumulative effects.

Conclusion

After reviewing the current status of the Lange's metalmark butterfly, the Antioch Dunes evening primrose, and the Contra Costa wallflower, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed vegetation management plan, using prescribed burns and other methods, is not likely to jeopardize the continued existence of the Lange's metalmark butterfly, the Antioch Dunes evening primrose, or the Contra Costa wallflower. No statutory critical habitat has been designated for the Lange's metalmark, therefore, none will be affected. The Service anticipates that the critical habitat of the evening primrose and the wallflower will be enhanced by the proposed action.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act prohibits take (i.e. to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harass is defined as an intentional or negligent act or omission 'which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns such as breeding, feeding, or sheltering. Incidental take is any take of listed animal species which results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the

terms of section 7(b)(4) and section 7(o)(2) taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the Refuge in order for the exemption in section 7(o)(2) to apply. The Refuge has a continuing duty to regulate the activity covered by this incidental take statement. If the Refuge: (1) fails to adhere to the terms and conditions of the incidental take statement, or require any applicant to adhere to these terms and conditions through enforceable terms that are added to the permit or and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

The Service anticipates that Lange's metalmark butterflies may be taken as a result of the proposed action, and that this take will be difficult to quantify due to the difficulty of finding dead or impaired specimens, whether as eggs, larvae, pupae, or adults. However, take of these butterflies can be defined by the loss of larval and nectar plant habitat, disturbance, and delay in the recovery of burned habitat. Implementation of the burn box experiment will result in take of 0.0086 acres of Lange's metalmark habitat and all associated life history stages of the butterfly (5 boxes containing buckwheat, times 7 square meters each). In addition, occasional, scattered buckwheat host plants may be killed in the large burn areas. These isolated plants are not anticipated to support the listed metalmark.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the listed species considered in this opinion, nor in destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measure is necessary and appropriate to minimize the impacts of the project on Lange's metalmark butterfly, the Antioch Dunes evening primrose, the Contra Costa wallflower, and species of concern that potentially occur within the action area:

> Minimize and mitigate the negative short- and long-term impacts of prescribed burning on Lange's metalmark butterfly, the Antioch Dunes evening primrose, the Contra Costa wallflower, and the Antioch Dunes ecosystem.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act,. the Refuge must comply with the following terms and conditions, which implement the reasonable and prudent measure above. These terms and conditions are nondiscretionary.

1. The Refuge shall not burn during the flight season of the Lange's metalmark butterfly, mid-July to the end of September.

2. As a contingency measure in the event of excessive stimulation of weedy vegetation in burn treatment areas (either non-native weeds or native invasive species such as yellow bush lupine) , the Refuge shall apply, in combination with burning, 'if appropriate, other appropriate vegetation suppression methods (e.g., herbicide(s), deep regrading, disking, manual weed removal).

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service believes that, annually, no more than 0.0086 acres of Lange's metalmark habitat and associated life history stages of the butterfly, and scattered unoccupied host plants will be incidentally taken. If, during the course of the action, this minimized level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. . The Refuge must then immediately investigate the causes of the taking and review the need for possible modification of the reasonable and prudent measures.

Reporting Requirements

Project personnel shall be required to report immediately any information about take or suspected take of Lange's metalmark. The Refuge shall record the date, time, and precise location of the incident/ specimen, and any other pertinent information. The reporting contact shall be the Office of Ecological Services, Endangered Species Division at 916-979-2752. Any Lange's metalmark butterflies found injured shall-be. turned in to the California Department of Fish and Game. The agency contact is the Supervisor of Environmental, Services of the California Department of Fish and Game (916-322-5574) . Any Lange's metalmark butterflies found dead shall be deposited in the insect collection of the California Academy of Sciences in San Francisco (415-750-7239).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibilities. The Service recommends the following actions to protect federally listed species and their habitats during the control program:

1. To increase the utility of data obtained from burn boxes containing evening-primrose and wallflower individuals, use demographic methods to monitor rare plant species (censuses of marked individuals, measurement of reproductive output) rather than estimates of plant cover. Supplement measurements of non-native species richness with measures of relative abundance or cover of dominant non-native species.

2. Add sub-treatments to the experimental burn treatments to assess the effects of mechanical disturbance (disking, plowing) before and during spring regeneration of dominant weeds.

3. Investigate the feasibility of grading portions of the Refuge to increase topographic relief, dune height, and the, frequency of steep north/northwest facing erosional slopes with sparse vegetation cover (blowouts, erosional scarps). This structural modification could be combined with experimental re-introduction of evening-primrose and wallflower at the updrift (windward) ends of blowout axes. Steepened dunes should be encouraged to remain erosional and mobile.

4. Provide copies of annual reports to the Endangered Species Division of the Service's Sacramento Field office.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the proposed plan to conduct prescribed burns and other vegetation management actions at the Refuge. As provided in 50 CFR § 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals that the action may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the project is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Refuge Complex Manager

If you have any questions regarding this opinion, please contact David Wright at (916) 979-2739, ext. 442, regarding butterflies, or Peter Baye at (707) 643-9116 regarding plants.

Sincerely,

for Wayne S. White
Field Supervisor

cc: AES, Portland, OR

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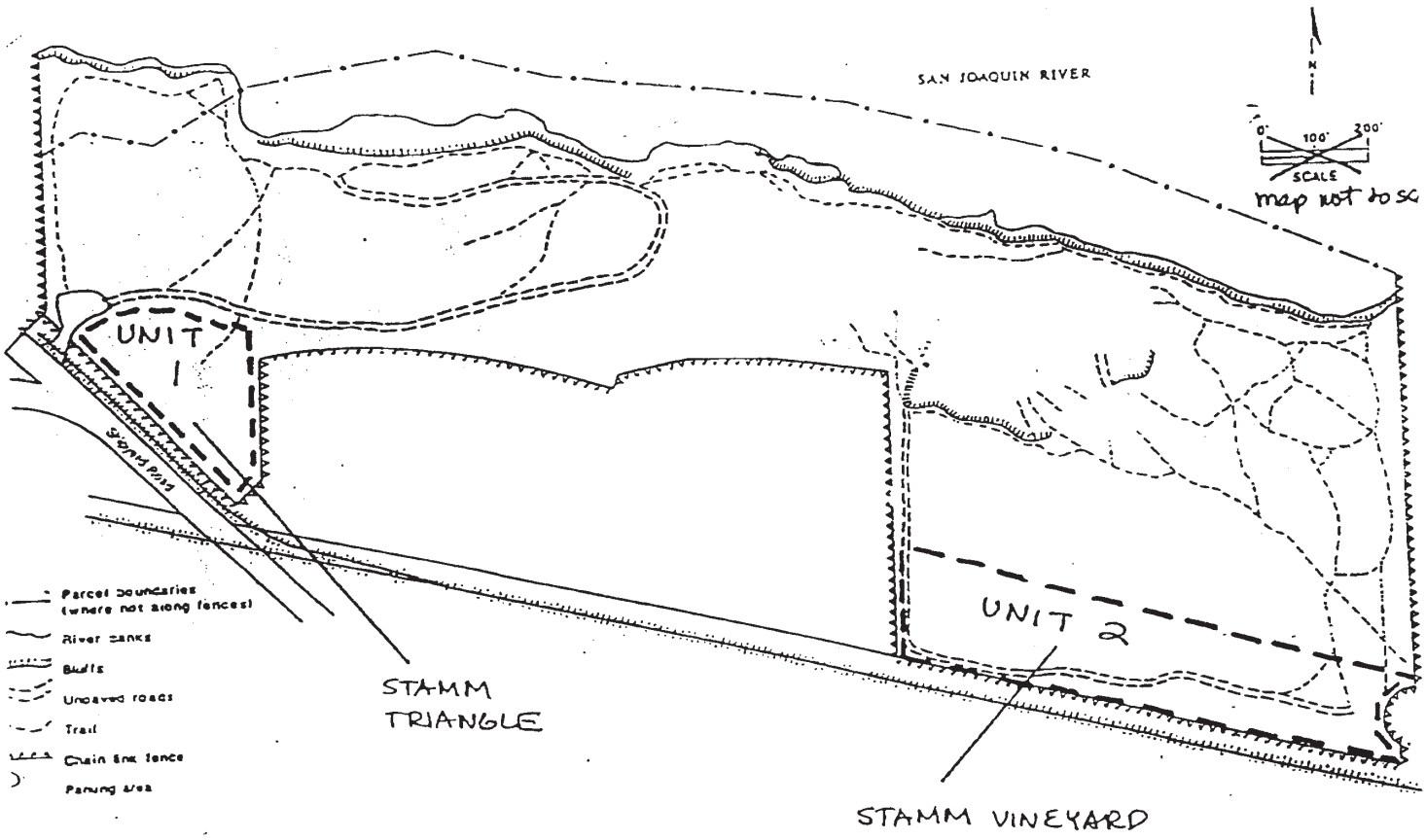
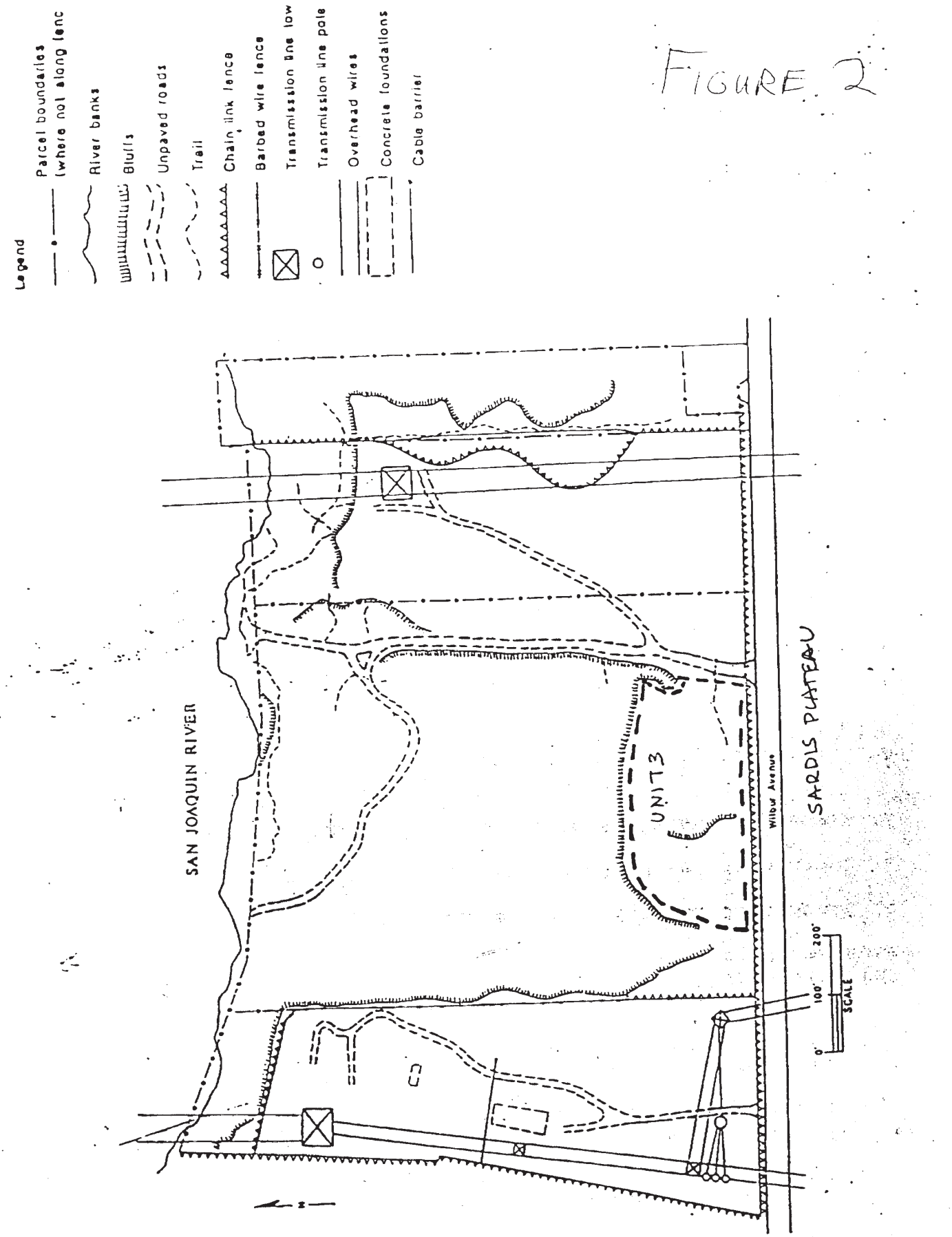
FIGURE 1



Antioch Dunes USFWS Stamm Parcel

)ER 1987

FIGURE 2


Legend
Parcel boundaries
(where not along fenc
River banks
Bluffs
Unpaved roads
Trail
Chain link fence
Barbed wire fence
Transmission line low
Transmission line pole
Overhead wires
Concrete foundations
Cable barrier
SAN JOAQUIN RIVER
UNIT 3
Willow Avenue
SARDIS PLATEAU
200'
100'
0'
SCALE

Appendix E: Sample Burn Plan

Refuge or Station: San Francisco Bay NWR Complex

Unit : Antioch Dunes NWR 11646 Date:

Prepared By: _____ Date: _____
Roger P. Wong
Prescribed Fire Burn Boss

Reviewed By: _____ Date: _____
ADR Assistant Refuge Manager

The approved Prescribed Fire Plan constitutes the authority to burn, pending approval of Section 7 Consultations, Environmental Assessments, or other required documents. No one has the authority to burn without an approved plan or in a manner not in compliance with the approved plan. Prescribed burning conditions established in the plan are firm limits. Actions taken in compliance with the approved Prescribed Fire Plan will be fully supported, but personnel will be held accountable for actions taken which are not in compliance with the approved plan.

Approved By: _____ Date: _____
Margaret Kolar
Project Leader
San Francisco Bay/Don Edwards NWR

PRESCRIBED FIRE PLAN

Refuge: San Francisco Bay NWR Complex Refuge Burn Number:

Sub Station: Antioch Dunes NWR Fire Number:
Name of Areas: Stamm Unit

Total Acres To Be Burned: 11 acres divided into 2 units to be burned over one day
Legal Description: Stamm Unit

T.2N; R.2E, Section 18
Lat. 38 01', Long. 121 48'

Is a Section 7 Consultation being forwarded to Fish and Wildlife Enhancement for review? Yes No (circle). Biological Opinion dated June 11, 1997

(Page 2 of this PFP should be a refuge base map showing the location of the burn on Fish and Wildlife Service land.)

The Prescribed Fire Burn Boss/Specialist must participate in the development of this plan.

I. GENERAL DESCRIPTION OF BURN UNIT

Physical Features and Vegetation Cover Types

Burn Unit 1B -- Stamm Unit - Hardpan (4 acres):
Predominantly annual grasses interspersed with YST and bush lupin "skeletons" from previous year's prescribed burn. Elevation approximately 15-20 feet. Primarily flat topography with some slight hummocks and elevational changes.
Sandy soils. This unit was burned in June 1999.

Burn Unit 2A -- Stamm Unit - Old Vineyard (7 acres):
Predominantly annual grasses interspersed with YST and non-native vetch. Elevation and soils same as above. This unit was burned in June 1997, 1998, 1999.

Map of Burn Units

Primary Resource Objectives of Unit

- Eliminate non-native vegetation and reduce seed bed of non-native forbs (YST, vetch etc.).
- Prepare the units for transplanting endangered plants by exposing the sandy soil substrate and reducing competition.

Objectives of Fire

1) Blacken at least 80% of overall unit.

2) Consume at least 70% of standing vegetation.

3) Remove at least 80% of accumulated litter in burned areas.

Acceptable Range of Results

1) 80% - 100% black acreage

2) 80% - 100% consumption of standing vegetation.

3) 80% - 100% litter removal in area burned.

II. PRE-BURN MONITORING

Hardpan

Vegetation Type		Acres	%	FBPS Fuel Model
annual grasses		70		1
star thistle		20		3
bush lupine		5		3
vetch		5		1
Total	4	100		1/3

Old Vineyard

vetch		70		1
annual grases		10		1
star thistle		20		3
Total	7	100		1/3

III. PLANNING AND ACTIONS

Complexity Analysis Results:

RISK -- MODERATE (due to urban interface and nearby smoke receptors)

Site preparation

Unit 1B -- Stamm Unit - Hardpan

The south boundary of this unit is an unimproved road that that will be opened up. Dozer line will be constructed along the east boundary of the unit leading down to the San Joaquin River. The north boundary will be the San Joaquin River. The west boundary will be the fenceline of Fulton Shipyard Road. A handcrew will lop and scatter any woody vegetation greater than 2 feet in height for distance of five feet from the east line..

Unit 2A -- Stamm Unit - Old Vineyard

A dozer line (1050 feet) will be constructed on the north side of this unit. A parking lot (Georgia Pacific Gypsum plant) and chain link fence borders the east flank. The south flank runs along the Santa Fe Railroad line. No site preparation is needed in that location. The boundary adjacent to the west line is a chain link fence separating the refuge from a borrow pit. A gate in the fence will provide access for engines and equipment.

Weather information required

No RAWS facilities are located in the area. The closest RAWS is located at Mount Diablo. Data collected from that site is of little value since Mount Diablo is well above sea level of the burn site. Therefore all site specific weather data must be collected manually by a trained weather observer every hour. The Burn Boss will ensure weather data will be taken every hour while conducting the burn. Spot weather forecast from Sacramento Fire Weather Office (NWS) will be requested thru Contra Costa County Fire Department in Antioch. The battalion headquarters is located approximately 7 miles from the burn site. Spot weather forecasts can be received on their FAX machine.

Insert complexity Analysis

Safety considerations and protection of sensitive features

Unit 1B -- Stamm Unit - Hardpan.
The Refuge is closed to public entry at all times. The Refuge parking lot (SW corner) will serve as a safety zone. The access road will be cleared of vegetation to serve as an escape route to the safety zone. The San Joaquin River to the north will also act as a safety zone. AD Refuge Manager will be responsible for contacting the City of Antioch Public Works (510-779-6967) the day before the burn and notify them of increased activity along Fulton Shipyard Road. AD Refuge Manager will contact adjacent landowners and businesses to prevent the parking of vehicles near the burn unit on the day of the burn.

Unit 2A -- Stamm Unit - Old Vineyard
Access for engines and equipment is through a gate on the west boundary of the burn unit. This gate will provide access to a safety zone in the borrow pit on private property adjacent to the burn unit boundary. Escape routes to the borrow pit will be along the 1050 foot control line that makes up the north boundary. Chain link fences enclose the east and south flanks making escape in these directions extremely difficult. NO PERSONNEL WILL WORK INSIDE THE BURN UNIT NEAR THESE FLANKS, unless they have "straight line" access to the escape route or safety zone. Phone contacts for Unit 1 apply.

Special Safety Precautions Needing Attention:
The Burn Boss will coordinate with the Contra Costa County Fire Department well in advance of ignition date to ensure radio/communication compatibility.

Media Contacts:
The AD Refuge Manager is responsible for notifying local publics affected by the operation thru local newspaper and other media.

Communications and Coordination on the Burn:
The Burn Boss will review the burn plan, radios, PPE, escape routes, safety zones and engines prior to burning. NIFC Tac-2 will be assigned radio frequency for all firing and holding operations (154.200). The Burn Boss will call start and declare out to the Contra Costa County Fire Department. The Burn Boss will brief the County Battalion Chief 1 week in advance of planned ignition date and will supply a copy of this burn plan 2 months in advance. In the event of a medical emergency or burn injury, the County Fire Department will assume control of the medical incident.

The Burn Boss will contact the Bay Area Air Quality Management District prior to ignition on the day of the burn as required by Regulation 5, Open Burning, Section 8, Allowable Fires (5-401), P - Wildland Vegetation Management, Item 5, and to ensure Burn Day Status.

IV. IGNITION, BURNING AND CONTROL

Scheduling: Approx. Date(s) — Planned or Proposed: June — Actual

FBPS Fuel Model 1	Low	High	Actual
Temperature			
Relative Humidity			
Wind Speed (20' forecast)			
Wind Speed (mid-flame)			
Cloud Cover (%)			
ENVIRONMENTAL CONDITIONS			
Soil Moisture			
1 hr. Fuel Moisture			
10 hr. FM			
100 hr. FM			
Woody Live Fuel Moisture			
Herb. Live Fuel Moisture			
Litter/Duff Moisture			
FIRE BEHAVIOR			
Type of Fire (H,B,F)			
Rate of Spread			
Fireline Intensity			
Flame Length			

Ignition Technique:

WHEN WINDS ARE FROM THE WEST

Unit 1B -- Stamm Unit - Hardpan 1

Establish blackline along the east dozer line. Once fire has burned at least 20 feet on the east flank, strip headfire in S-N lines (unimproved road to San Joaquin River). Continue strip firing to Fulton Shipyard fenceline.

Unit 2A -- Stamm Unit - Old Vineyard.

Establish secure blackline along E boundary (adjacent to gypsum plant). Once backing fire has burned in at least 20 feet along E flank, begin strip headfire starting downwind working upwind. Widen strips as fire behavior and safety dictates. All strip fires should spread in a W - E direction bumping into black along the E flank.

Prescribed Fire Organization (See Section VII, Crew and Equipment Assignments. All personnel and their assignments must be listed. All personnel must be qualified for the positions they will fill.)

A minimum of 3 Type 4 engines will be on site during ignition. Personnel will rotate between ignition and holding actions.

Prescription monitoring (Discuss monitoring procedure and frequency to determine if conditions for the burn are within prescription):

BEHAVE predictions will model fire behavior. Belt weather kit will be used to monitor actual burn day weather conditions.

V. SMOKE MANAGEMENT

Permits required:

This burn plan will be submitted to the Bay Area Air Quality Management District (BAAQMD) 30 days in advance of planned ignition. Written approval by BAAQMD is required. The Burn Boss will submit a Controlled Burn Request Form 7 days prior to the proposed ignition date if there is any uncertainty regarding possibility of a "No-Burn Day". This burn plan meets criteria and will be submitted under Regulation 5, Open Burning, Section 8 Allowable Fires, P - Wildland Vegetation Management:

"...application of fire to vegetation to achieve a specific natural resource management objective... These fires are conducted within the limits of a written burn plan and prescription...to achieve the desired effects."

Distance and Direction from Smoke Sensitive Area(s):

A large portion of the City of Antioch lies south and east of the proposed burn area. Smoke will inevitably drift towards these areas. Numerous smoke receptors will be effected by the burn.

Necessary Transport Wind Direction, Speed and Mixing Height (Explain how this information will be obtained and used):

Winds will be NW to SE or W to E. When requesting the spot weather forecast mixing height and transport wind speed for that particular day will be requested. Actual mixing height will be determined by the test burn. A minimum of 1,000 foot mixing height is desired.

Visibility Hazard(s) (Roads, airports, etc.):
Santa Fe, Atchison and Topeka Railroad lies directly south of Burn Unit 2. Fulton Shipyard Road lies directly south of Burn Unit 1. Wilbur Road lies directly south of Burn Unit 3.

Actions to Reduce Visibility Hazard (s)

Burning will begin in late-morning (1100) to mid-afternoon (1300) when unstable atmospheric conditions enhance smoke dispersal. The Burn Boss will monitor the smoke dispersal from backing fires prior to interior firing. City of Antioch Public Works will be contacted approximately 1 week prior to the proposed burn date. The Refuge Manager will contact Public Works on the day of the burn to confirm the activity. The Refuge Manager will contact the City of Antioch Police Department the day of the burn to notify them of potential smoke across the roads. The Burn Boss will be responsible for contacting the Santa Fe Railroad 1 week prior and the day of the burn to advise them of smoke drifting across their tracks.

Residual Smoke Problems:

Mop up activities should be minimal due to almost complete consumption of 1 hour target fuels. All smokes and hot spots be mopped up (100% mop up) before moving on to burn next unit.

Particulate emissions in Tons/Acre and how calculated:

Assume Total PM Emission Factor for grass is 10 lbs/ton; assume 100% consumption. Estimated fuel loading for the entire burn is 200 lbs/ac.

CALCULATIONS:

200 lbs/ac X 1 ton/2000 lbs = 0.1 tons/ac TOTAL FUEL CONSUMED

Total Fuel Consumed (0.1 tons/ac) X Emission Factor (10 lbs/ton)
=1.0 lbs/ac TOTAL EMISSIONS

Total burned area acreage (11 ac) X Total emissions (1.0 lbs/ac) = 11.0 lbs of EMISSIONS RELEASED FOR ENTIRE BURN over a1 day period.

VI. FUNDING AND PERSONNEL

Activity Code: _____

Costs

	Equipment & Supplies	Labor	Over-time	Staff Days	Total Cost
Admin. (planning, permits, etc.)					
Site Preparation					
Ignition & Control					
Travel/Per Diem					
Total					

VI. BURN-DAY ACTIVITIES

Public/Media Contacts on Burn Day (List with telephone numbers):

Santa Fe Railroad (Pittsburg, CA)
Bob Tidwell, Security Agent - 510-231-2754
John Cockle, Train Master - 510-231-2603
Contra Costa County Fire Department
Tony Cambell, Chief Officer - 510-930-5551
Jay Highson, Training Officer - 510-930-5500
Operations Officer - 510-757-1303
Bay Area Air Quality Management District
Daniel Belick, Air Quality Specialist - 415-749-4786
Doug Tolar, Enforcement Program Specialist - 415-749-5118
(FAX) 415-928-0338
Burn Day Status Pre-recording 1-800-435-7247
City of Antioch Public Works
Mike Bechteloldt, Supervisor - 510-779-6967

Crew & Equipment Assignments (List all personnel, equipment needed, and assignments. The following is not an all-inclusive list for what you may need.)

See chart

Crew Briefing Points:

Communications - NIFC Tac-2 (154.200) to be designated operations frequency
Hazards - LCES will be reviewed for each individual burn unit. Specific hazards pertaining to each unit will be discussed.
Escape Fire - Holding Boss will be identified and actions will be discussed.
Coordination - County Fire personnel to be available for medical response if necessary.

Personnel Escape Plan:

Discussed in Safety Considerations in Planning Actions.

Special Safety Requirements:

There are clearly identifiable safety concerns on all 2 burn units. Though these units are small in size, FIREFIGHTER SAFETY WILL BE PARAMOUNT when conducting this burn. Fuels are flashy with rapid rates of spread. For that reason, NO ONE WILL WORK ALONG THOSE FLANKS WHERE ESCAPE ROUTES ARE NOT DIRECTLY ACCESSIBLE.

Holding and Control:

Critical Control Problems:

The key to holding the Hardpan 1 fire will be in the integrity of the control line along the east boundary. The critical holding point on the Old Vineyard fire will be west and north boundaries. As long as winds are west or northwest we will not have any control problems.

Water Refill Points:

Water may be drafted from nearby fire hydrant at Fulton Shipyard Road
500 gallon "pumpkin" tank may be set up on site.

Contingency Plan for Escaped Fire (Are there crews standing by to initial attack or will people doing other jobs be called upon to do initial attack, who must be called in case of an escape, what radio frequencies will be used, etc.)

If the fire escapes the burn unit and remains within the refuge boundary, FWS will assume the command of the incident. If the fire escapes the burn unit and threatens local responsibility protection area, Unified Command between FWS and County Fire will be assumed. In the event of an escaped fire, direct attack methods will be used. Contra Costa County Fire Dept will be contacted immediately for any structural protection needs or reinforced attack in the case of vegetation fire. SNL staffed engines will be primary initial attack units if the fire escapes. SFR Pumper will be used for mop up and patrol only.

Mop Up and Patrol:

All smokes will be put out by the holding crew prior to leaving the site. The Burn Boss and Refuge Manager will patrol the burn site the next morning to check for smokes or hot spots that may have been missed the day before.

VIII. CRITIQUE OF BURN

Were burn objectives within acceptable range of results? (Refer to Section I):

What would be done differently to obtain results or get better results?

Was there any deviation from plan? If so, why?

Problems and general comments:

X. POST-BURN MONITORING

Date:_____ Refuge Burn Number: _____

Length of Time after Burn: _____

Vegetative Transects:

Comments on Habitat Conditions, etc.:

Photo Documentation:

Other:

X. FOLLOW-UP EVALUATION

Date: _____ Refuge Burn Number: _____

Length of Time after Burn: _____

Vegetative Transects:

Comments on Habitat Conditions, etc.:

Photo Documentation:

Other:

APPENDIX F: DISPATCH PLAN

When a report of smoke or fire on the Refuge is received, get as much information from the caller or messenger as possible:

Location of smoke or fire?
Location of caller?
Name and telephone number or contact point of the caller or messenger?
Color of smoke?
Size of fire?
Type of fuel (What is burning?)
Character of the fire (Active, smoldering, etc.)?
Is anyone fighting the fire? How many personnel? Equipment?
Did they see anyone in the vicinity or vehicles leaving the area?
Is the fire site accessible by a slip-on unit?
What are the weather conditions at the fire?

1) Report to:

Contra Costa County Fire Protection District (925)930-5500 or 9-1-1

The Contra Costa County Fire Protection District is dispatched through this central system. The Refuge is currently working with the County to put lock boxes on both Refuge Units.

Addresses: Sardis Unit #1551 Wilbur Avenue
Stamm Unit #501 Fulton Shipyard road

2. Due to the distance of Antioch Dunes NWR from the Fremont HQ, the fire will likely have already been extinguished before Refuge personnel arrive. However, a Refuge police officer and Refuge firefighter unit should be dispatched for mop-up, fire investigation and report purposes.

3. If discovered while on the Refuge, call 911 or the Protection District at (925) 930-5500 or Refuge Headquarters (510)792-0222 for assistance.

4. Dispatch Refuge firefighters if the fire is on the Refuge or threatens Refuge property.

5. Notify Refuge Manager, Project Leader, on-duty Police Officer, and Zone Management Officer (Roger Wong -209/826-3508; Home (209) 827-4390).

6. For fires occurring at night or on weekends, the following individuals should be notified in order:

a. On-call Refuge Officer: Call Park Police Dispatch (415)561-5510

Headquarters (510) 792-0222
Barry Tarbet (510) 247-3357 (home) Cell (510) 377-5852
Jon Adamson (510) 782-1154 (home) Cell (510) 377-5885

b. Refuge Manager
Chris Bandy (510) 814-1053 (home) Cell (510) 377-5928

c. Refuge Officers:
Barry Tarbet (510)247-3357
Jon Adamson (510)782-1154

d. Project Leader
Marge Kolar (510)745-0332 Cell (510) 377-9450

e. Wildlife Biologist
Ivette Loredo (510)377-5956 Cell

f. Zone Fire Management Officer
Roger Wong (209)826-3508 Cell (209) 704-4508

g. Refuge Firefighters: Juan Flores, Chris Bandy, Joy Albertson,, Mike Parker, Arthur Chan, Joelle Buffa

7. Other Refuge Personnel (cell phone #):

Clyde Morris	510-377-2781
Carmen Leong	510-377-9229
Brian Allen	510-377-5926
Bryan Winton	707-975-5521
Joelle Buffa	510-377-5958
Joy Albertson	510-377-5693
Art Chan	510-377-3119
Juan Flores	510-377-5891

8. Other personnel to be involved if necessary:

Pam Ensley, Regional Fire Management Coordinator,
Regional Office: (503) 231-6174 or residence (360) 835-7004

Andy Anderson, Regional Fire Management Officer
Regional Office: (503) 231-6175 or (360) 666-5031 residence

Roddy Baumann, Regional Prescribed Fire Specialist
Regional Office: (503) 231-2075 or (360) 573-9444 residence

Mendocino National Forest Communications Center, Willows, CA
1-888-663-3479

APPENDIX G: DELEGATION OF AUTHORITY

Antioch Dunes NWR

Delegation of Authority
for

_____ Incident

_____ is assigned as Incident Commander. You have full authority and responsibility for managing the fire suppression activities within the framework of laws, Agency policy, and direction provided in the Wildland Fire Situation Analysis and the Agency Administrator Briefing.

Your primary responsibility is to organize and direct your assigned resources for efficient and effective suppression of the fire. You are accountable to the Agency Administrator or the representatives designated below.

Specific direction for this incident covering management and environmental concerns are:

1. Protection of life and private property is your highest priority task.
2. Give special consideration to firefighter safety, especially with respect to aviation operations, working around dozers, snags, and entrapments. Avoid sensitive environmental areas. When in doubt, sacrifice acres not people in your strategic and tactical decisions.
3. You are authorized to utilize helicopters, chainsaws, portable pumps, fireline explosives, and retardant at Antioch Dunes NWR. You are not authorized to use equipment within the _____.
4. Manage human resources assigned to the fire in a manner that promotes mutual respect and is consistent with the enclosed U.S. Fish & Wildlife Service "Harassment-Free Workplace" policy.
5. Be cost effective; Final costs should be no more than 120% of the preferred WFSA alternative.
6. Manage equipment and supplies to ensure losses are within Acceptable Fire Loss/Use Rates.

You should takeover management of the incident on or before _____, _____.

_____ _____
Marge Kolar, Project Leader, Antioch Dunes NWR Date

Delegation of Authority - Guidelines for Mitigating the Effects of Fire Suppression

LINE BUILDING

1. Do not fall snags on the outside of the line unless they are an obvious safety hazard.
2. On the inside of the line, fall only those snags that would reach the fire line should they burn and fall over, or if they are an obvious safety hazard.
3. Don't cut live trees over 12" d.b.h. unless deemed absolutely necessary by the Complex Manager. Limbing of these trees, as necessary, should be the first choice.
4. Cut brush or small trees flush with the ground if the area is visible from roads.
5. Lop and scatter cut limbs so the depth will not exceed 15 inches.

MOP-UP

1. Extinguish fire in living trees or snags within 200 feet of the fires perimeter with water or dirt. Fell those trees as a last resort.
2. If felling occurs in the vicinity of service roads/trails, cut the stumps flush with the ground.
3. Buck fallen trees across service roads/trails only to the extent necessary to facilitate road/trail passage.

AIR OPERATIONS

1. Consider fixed wing delivery of water vs. standard colored retardant.
2. When possible, use long line slings instead of cutting helispots.
3. ETC. ADD ANY OTHERS HERE.

APPENDIX H: NOTIFICATION LIST FOR PRESCRIBED BURNING

Pacific Gas and Electric Company, Attn: Sally de Becker, Biologist
3400 Crow Canyon Road
San Ramon, CA 94583
(925) 866-5836

Santa Fe Railroad, Attn: Larry Hartman, Terminal Manager
303 South Garrard Blvd.
Richmond, CA 94801
(510) 231-2603/2601/2754

Contra Costa Fire Department, Attn: Tony Cambell
2010 Geary Rd.
Pleasanthill, CA 94523
(925) 930-5551

City of Antioch Public Works, Attn: Ron Ullman, Supervisor
P.O. Box 5007
Antioch, CA 94531-5007
(925) 779-6967

GP Gypsum Plant, Attn: Tim Trichart
P.O. Box 460
Antioch, CA 94509
(925) 757-2870
(925) 757-8540 (fax)
Ask them to move cars from west boundary

Kemwater
2151 Wilbur Ave.
Antioch, CA 94509
(925) 757-8230

Fulton Shipyard Inc., Attn: Leslie Fulton
307 Fulton Shipyard Rd.
Antioch, CA 94509
(925) 757-2611

Inland Marine
801 Fulton Shipyard Road
Antioch, CA 94509
(925) 757-1714

Antioch Police Department
300 L. Street
Antioch, CA 94509
(925) 779-6900

REQUEST FOR CULTURAL RESOURCE COMPLIANCE

U.S. Fish and Wildlife Service, Region 1

Project Name:					Program: (Partners, Refuges, JITW, WSECP, etc.)	
State: CA, ID, HI, NV, OR, WA		EcoRegion: CBE, IPE,KCE, NCE			**FWS Unit: Org Code:**	
Project Location:	**County**	**Township**	**Range**	**Section**	FWS Contact: Name, Tel#, Address	
USGS Quad:					**Date of Request:**	
Total project acres/linear ft/m:		APE Acres / linear ft/m (if different)			**Proposed Project Start Date:**	

MAPS Attached	Check below		
Copy of portion of USGS Quad with project area marked clearly (required)			Project (sketch) map showing Area of Potential Effect with locations of specific ground altering activities (required)
Photocopy of aerial photo showing location (if available)			Any other project plans, photographs, or drawings that may help CRT in making determination (if available)

Directions to Project: (if not obvious)	
Description of Undertaking:	Describe proposed project and means to facilitate (e.g., provide funds to revegetate 1 mile of riparian habitat, restore 250 acres of seasonal wetlands, and construct a 5-acre permanent pond). How is the project designed (e.g., install 2 miles of fence and create approximately 25' of 3' high check dam)?

Area of Potential Effects (APE):	Describe where disturbance of the ground will occur. What are the dimensions of the area to be disturbed? How deep will you excavate? How far apart are fenceposts? What method are you using to plant vegetation? Where will fill be obtained? Where will soil be dumped? What tools or equipment will be used? Are you replacing or repairing a structure? Will you be moving dirt in a relatively undisturbed area? Will the project reach below or beyond the limits of prior land disturbance? Differentiate between areas slated for earth movement vs. areas to be inundated only. Is the area to be inundated different from the area inundated today, in the recent past, or under natural conditions? Provide acres and/or linear ft/m for all elements of the project.
Environmental and Cultural Setting:	Briefly describe the environmental setting of the APE. A) What was the natural habitat prior to modifications, reclamation, agriculture, settlement? B) What is land-use history? When was it first settled, modified? How deep has it been cultivated, grazed, etc.? C) What is land use and habitat today? What natural agents (e.g., sedimentation, vegetation, inundation) or cultural agents (e.g., cultivation) might affect the ability to discover cultural resources? D) Do you (or does anybody else) know of cultural resources in or near the project area?

Appendix K
Glossary of Terms

Appendix K - Glossary of Terms

Adaptive Management	The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels.
Alternatives	Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues.
Approved Refuge Boundary	An approved refuge boundary gives the Service authority to acquire land contained within the boundary. The approved Refuge boundary identifies important and sensitive resource areas that the Service is looking to protect for a long period of time. Landowners within a refuge boundary retain all the rights, privileges, and responsibilities of private land ownership. After the Director approves a refuge boundary, the Service can make offers to purchase land, or enter into management agreements with willing landowners within the approved boundary. Lands do not become part of the National Wildlife Refuge System unless they are purchased or are placed under a management agreement with the individual landowner.
Biological Diversity	The variety of life, including the variety of living organisms, the genetic differences among them, and the communities in which they interact.
Biological Integrity	Biotic composition, structure, and function at the genetic, organism, and community levels consistent with natural conditions, including the natural biological processes that shape genomes, organisms, and communities.
CFR	Code of Federal Regulations.
Compatible Use	A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgement of the director, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purpose of the refuge unit (Service Manual 603 FW 3.6).
Comprehensive Conservation Plan (CCP)	A plan that: (1) describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve refuge purposes; (2) helps fulfill the mission of the Refuge System; (3)

maintains and where appropriate restores the ecological integrity of each refuge and the Refuge System; (4) helps achieve the goals of the National Wilderness Preservation System; and (5) meets other mandates.

Concern See Issues.

Coordination Area A wildlife management area made available to a State, by "(A) cooperative agreement between the United States Fish and Wildlife Service and the State fish and game agency pursuant to Section 4 of the Fish and Wildlife Coordination Act (16 U.S.C. 664); or (B) long-term leases or agreements pursuant to the Bankhead-Jones Farm Tenant Act (50 Stat. 525; 7 U.S.C. 1010 et seq.)." States manage Coordination Areas, but they are part of the Refuge System. CPPs are not required for Coordination Areas.

Cultural Resource Overview A comprehensive document prepared for a field office that discusses, among other things, an area's prehistory and cultural history, the nature and extent of known cultural resources in the area, relevant previous research, management objectives, and resource management conflicts or issues, and provides a general statement of how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field office's background or literature search as described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).

Cultural Resource Inventory A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Various levels of cultural resources inventories include background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, and sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Designated Wildernesss Area An area designated by the United States Congress for management as a part of the National Wilderness Preservation System (Service Manual 610 FW 1.5).

Ecological Integrity The integration of biological integrity, natural biological diversity, and environmental health; replication of natural ecological conditions.

Ecosystem A biological community together with its environment, functioning as a unit. For

	administrative purposes, we have designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries, and their sizes and ecological complexity vary.
Ecosystem Approach	An approach to conservation and restoration that focuses on protecting or restoring the natural function, structure, and species composition of an ecosystem, recognizing that all components are interrelated.
Environmental Health	Abiotic composition, structure and function of the environment consistent with natural conditions, including the natural abiotic processes that shape the environment.
Environmental Impact Statement (EIS)	A detailed written statement, required by section 102(2)(C) of the National Environmental Policy Act, that analyzes the environmental impacts of a proposed action, including unavoidable adverse effects of the project, the alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of the long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).
Environmental Assessment (EA)	A concise public document prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose of and need for an action and the reasonable alternatives to the action, and analyzes the action's potential impacts in sufficient detail to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).
Finding of No Significant Impact (FONSI)	A document prepared in compliance with the National Environmental Policy Act and supported by an environmental assessment that briefly explains why a Federal action will have no significant effect on the natural or human environment (40 CFR 1508.13).
Goal	Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units.
Issue	Any unsettled matter that requires a management decision, such as initiative, opportunity, resource management problem, threat to the resources of the unit, conflict between uses, public concern, or the presence of an undesirable resource condition.
Management Alternative	See Alternative.
Management Concern	See Issue

Management Opportunity	See Issue
Mission Statement	Succinct statement of the unit's purpose and reason for being (Region 7 Planning Staff).
National Wildlife Refuge (refuge)	A designated area of land or water, or an interest in land or water, within the Refuge System (excluding Coordination Areas). Find a complete listing of all units of the Refuge System in the current Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service.
National Wildlife Refuge System Mission (mission)	"The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."
National Wildlife Refuge System, Refuge System, or System	Various categories of lands, waters, and interests therein that are administered by the Secretary of the Interior for the protection, conservation, and where appropriate, restoration of fish and wildlife including species that are threatened with extinction; includes wildlife ranges, game ranges, and wildlife management or waterfowl production areas.
No Action Alternatives	An alternative under which existing management would be continued.
Nonpriority Public Uses	Any use other than a compatible wildlife-dependent recreational use.
Notice of Intent (NOI)	A notice, published in the Federal Register, that an environmental impact statement will be prepared and considered (40 CFR 1508.22).
Objective	A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Objectives should be attainable, time-specific, and measurable.
Opportunities	Potential solutions to Issues.
Planning Area	The area upon which a planning effort will focus. A planning area may include lands outside existing planning unit boundaries currently under study for future inclusion in

	the Refuge System and/or partnership planning efforts. It also may include watersheds or ecosystems that are outside our jurisdiction but affect the planning unit. At a minimum, the planning area includes all lands within the approved refuge boundary.
Planning Team	Planning teams are interdisciplinary in membership and function. Teams generally consist of a Planning Team Leader, the Refuge Manager and staff biologist, a state natural resource agency representative, and other appropriate program specialists (e.g., social scientist, ecologist, recreation specialist). We also will ask other Federal and Tribal natural resource agencies to provide team members, as appropriate. The Planning Team prepares the CCP and appropriate NEPA documentation.
Planning Unit	A single refuge, ecologically or administratively related refuge complex, or distant unit of a refuge. The planning unit also may include lands currently outside refuge boundaries.
Preferred Alternative	The Service's selected alternative at the draft CCP stage.
Prescribed Fire	The application of fire to wildland fuels to achieve identified land use objectives (Service Manual 621 FW 1.7). May be ignited naturally or intentionally.
Priority Public Uses	Compatible wildlife-dependent recreation uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are the priority general public uses of the System and shall receive priority consideration in refuge planning and management.
Proposed Action	The Service's proposed action for Comprehensive Conservation Plans is to prepare the CCP and implement the preferred alternative it outlines.
Public Involvement	The process by which interested and affected individuals, organizations, agencies, and governmental entities participate in the planning and decision-making process.
Public Involvement Plan	Broad long-term guidance for involving the public in the comprehensive planning process.
Public	Individuals, organizations, and groups; officals of Federal, State, and local government agencies; Native American tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or

	may not have indicated an interest in Service issues and those who do or do not realize that Service decisions may affect them.
Purpose of the Refuge	"The purpose specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding refuge, refuge unit, or refuge subunit." For refuges that encompass wilderness designated by Congress the purposes of the Wilderness Act are additional purposes of the refuge.
Refuge Goal	See Goal.
Step-Down Management Plan	A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives.
Stakeholders	The people who have a direct interest or involvement in something (usually open space or urban lands or a plan for the management of such lands). Stakeholders in a CCP usually include Service staff and members of the local community.
Strategy	A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives.
Tiering	The practice of covering general matters in broader ("programmatic") environmental impact statements with subsequent narrower ("focused") statements addressing specific issues; focused documents incorporate by reference the general discussions in the broader document (40 CFR 1508.28).
Trust	Descibes a resource that is committed to the stewardship of a legally responsible agency (trustee agency) to be cared for or preserved in the public interest. E.g., trust species.
Undertaking	A project or plan initiated or overseen by a Federal agency; roughly equivalent to the NEPA usage of action.
Unit Objective	See Objective.
U.S. Fish and Wildlife Service Mission	Our mission is working with others to conserve, protect, and enhance fish, wildife, and plants and other habitats for the continuing benefit of the American people.

Vision Statement	A concise statement of the desired future condition of the planning unit, based primarily upon the Refuge System mission, specific refuge purposes, and other relevant mandates (Service Manual 602 FW 1.5).
Wilderness	See Designated Wilderness.
Wilderness Reivew	The process we use to determine whether we should recommend Refuge System lands and waters, to Congress for wilderness designation. The wilderness review process consists of three phases: inventory, study, and recommendation. The inventory is a broad look at the refuge to identify lands and waters that meet the minimum criteria for wildernesss. The study evaluates all values (ecological, recreation, cultural), resources (e.g., wildlife, water, vegetation, minerals, soils), and uses (management and public) within the Wilderness Study Area. The findings of the study determine whether we will recommend the area for designation as wilderness.
Wildfire	A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).
Wildland Fire	Every wildland fire is either a wildfire or a prescribed fire (Service Manual 621 FW 1.3).
Wildlife-Dependent Recreational Use	"A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Widlife-dependent recreational uses, other than the six prioprity public uses, are those that depend on the presence of wildlife. We consider these other uses in the preparation of refuge CCPs; however, the six priority public uses will always take precedence.